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# Tijdschrift voor Entomologie

A journal of systematic and evolutionary  
entomology since 1858



**Netherlands Journal of Entomology**  
Published by the Netherlands Entomological Society

# Tijdschrift voor Entomologie

A journal of systematic and evolutionary entomology since 1858

## Scope

The 'Tijdschrift voor Entomologie' (Netherlands Journal of Entomology) has a long tradition in the publication of original papers on insect taxonomy and systematics. The editors particularly invite papers on the insect fauna of the Palaearctic and Indo-Australian regions, especially those including evolutionary aspects e.g. phylogeny and biogeography, or ethology and ecology as far as meaningful for insect taxonomy. Authors wishing to submit papers on disciplines related to taxonomy, e.g. descriptive aspects of morphology, ethology, ecology and applied entomology, are requested to contact the editorial board before submitting. Usually, such papers will only be published when space allows.

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## GENERIC NAMES OF COLLEMBOLA:

### SUPPLEMENT 1984 – 1996

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Bellinger, P. F. & W. N. Ellis, 1997. Generic names of Collembola: supplement 1984-1996. – Tijdschrift voor Entomologie 140: 1-11 [ISSN 0040-7496]. Published 31 October 1997.

This is a second update to the list of Collembolan generic names published by the authors in 1973, covering names and nomenclatural actions that have come to our attention since 1984 and through 1996. Some 134 new generic names are included, with bibliographic citations and indications of type species. Some corrections to the earlier lists and some comments on previously described genera are included. The new name *Linasa* is proposed to replace *Silana* Yoshii & Suhardjono, preoccupied.

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Key words. – Collembola; nomenclature.

Our previous lists of generic names of Collembola were published in 1973 and 1984. Proposal of new names has continued, and a few earlier entries require modification for various reasons. All new names have again been checked against Neave's Nomenclator Zoologicus and its supplements, and against the lists of new generic and subgeneric names appearing annually in part 20 of the Zoological Record; as a consequence, we propose one new name here to replace a junior homonym.

We take this opportunity to acknowledge the assistance of our colleagues who have sent copies of their papers. We particularly wish to thank Miguel Alonso-Zarazaga for calling our attention to a potentially serious problem in nomenclature, to Dr. Marcia Edwards for comments on this matter, and to Dr. Eryzo Yoshii for authorizing the renaming of his pre-occupied name *Silana*.

As in our first supplement, we have marked new taxa with an asterisk \* and the gender of the names is abbreviated as F(emale), M(ale) and N(euter).

#### *Acherongia* Massoud & Thibaud, 1985\*

Annls Soc. ent. Fr.(2)21: 40.

Type species: *A. minima* Massoud & Thibaud, 1985, l.c., by original designation. F

#### *Albanura* Deharveng, 1982

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 3(4): 13.

Type species: *Neanura* (*Deutonura*) *nana* Cassagnau & Peja, 1979, by original designation. F

Note: This is the valid proposal of the name *Albanura*, incorrectly credited to Cassagnau in the first supplement.

#### *Allocyrtus* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 44, ut subgenus *Ascocyrtus* Yosii, 1963.

Type species: *Acanthurella lepidornata* Handschin, 1930, by original designation. M

Note: the junior author's name is given as 'Yayuk R. S.' in the table of contents of the issue.

#### *Allonychiurus* Yoshii, 1995\*

Ann. spel. Inst. Japan 13: 8, ut subgenus *Onychiurus* Gervais, 1841.

Type species: *Onychiurus flavescens* Kinoshita, 1916, by original designation. M

#### *Americabrya* Mari Mutt & Palacios-Vargas, 1987\*

J. N. Y. ent. Soc. 95(1): 100.

Type species: *Janetschekbrya arida* Christiansen & Bellinger, 1980, by original designation. F

#### *Antarctophorus* Potapov, 1992\*

Revue Écol. Biol. Sol 28(4): 492.

Type species: *Anurophorus subpolaris* Salmon, 1962, by original designation. M

*Anurachorutes* Kuznetsova & Potapov, 1988\*

Zool. Zhurn. 67 (12): 1836.

Type species: *A. martynovae* Kuznetsova & Potapov, 1988, l.c., by original designation. *M*

[*Archifurca* Richards, 1956\*]

Thesis: 89.

Type species: *A. coachellae* Richards, 1956, l.c., by original designation. *F*

Note: since Richards' thesis is technically unpublished these names have no standing in nomenclature.

*Austrocyrtus* Yoshii, 1989\*

Contr. biol. Lab. Kyoto Univ. 27: 234, ut subgenus *Pseudosinella* Schäffer, 1897.

Type species: *P. (A.) speciosa* Yoshii, 1989, l.c., by original designation. *M*

*Austrodonella* Ellis & Bellinger, 1973

Note: Possible junior objective synonym of *Tridontella* Stach, 1949; see below.

*Austroseira* Yoshii & Suhardjono, 1992\*

Acta zool. Asiae orient. 2:23, ut subgenus *Seira* Lubbock, 1869.

Type species: *Lepidocyrtus schaefferi* Schött, 1901, by original designation. *F*

*Bagnallophorus* Weiner, 1996\*

Annls Soc. ent. Fr. (N. S.) 32 (2): 183.

Type species: *Onychiurus normalis* Gisin, 1949, by original designation. *M*

*Batikphysa* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 74, ut subgenus *Callyntrura* Börner, 1906.

Type species: *C. (B.) batik* Yoshii & Suhardjono, 1989, l.c., by original designation. *F*

*Bessoniella* Deharveng & Thibaud, 1989\*

Bull. Mus. natl Hist. nat. Paris (4) 11A (2): 398.

Type species: *B. procera* Deharveng & Thibaud, 1989, l.c., by original designation. *F*

*Blasconurella* Deharveng & Bedos, 1992\*

Trop. Zool. 5 (2): 300.

Type species: *B. arcuata* Deharveng & Bedos, 1992, l.c., by original designation. *F*

*Blissia* Rusek, 1985\*

Can. J. Zool. 63 (9): 2077.

Type species: *B. glabra* Rusek, 1985, l.c., by original designation. *F*

*Botryanura* Chelnokov, 1987\*

Ent. Obozr. 66 (1): 100, ut subgenus *Entomobrya*

Rondani, 1861.

Type species: *E. (B.) oleniensis* Chelnokov, 1987, l.c., by original designation. *F*

*Boudinotia* Weiner & Najt, 1991\*

Mém. Mus. natl Hist. nat. Paris (A) 149: 121.

Type species: *B. prima* Weiner & Najt, 1991, l.c., by original designation. *F*

*Caledonura* Deharveng, 1988\*

Mém. Mus. natl Hist. nat. Paris (A) 142: 49.

Type species: *C. tillierae* Deharveng, 1988, l.c., by original designation. *F*

*Calvinura* Cassagnau, 1988\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 5(4): 23.

Type species: *C. besucheti* Cassagnau, 1988, l.c., by original designation. *F*

*Camerounura* Cassagnau, 1991\*

Revue Écol. Biol. Sol 28 (2): 221.

Type species: *C. delamarei* Cassagnau, 1991, l.c., by original designation. *F*

*Cansilianura* Dallai & Fanciulli, 1983\*

Redia 66: 235.

Type species: *C. malatestai* Dallai & Fanciulli, 1983, l.c., by original designation. *F*

*Carocyrtus* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 44, ut subgenus *Acrocyrtus* Yosii, 1959.

Type species: *Lepidocyrtus (Acrocyrtus) carosus* Yosii, 1959, by original designation. *M*

See note on authorship under *Allocyrtus*, above.

*Catalanura* Deharveng, 1982\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 3(4): 15.

Type species: *Neanura (Deutonura) catalana* Deharveng, 1979, by original designation. *F*

Note: this is the valid proposal of the name incorrectly credited to Cassagnau in the first supplement.

*Caucasanura* Kuznetsova & Potapov, 1988\*

Zool. Zhurn. 67 (12): 1837.

Type species: *C. stebaevae* Kuznetsova & Potapov, 1988, l.c., by original designation. *F*

*Caufrenyllodes* Greenslade & Deharveng, 1984\*

J. Aust. ent. Soc. 23 (3): 224.

Type species: *C. bacilloformis* Greenslade & Deharveng, 1984, l.c., by original designation. *M*

*Cephalachorutes* Bedos & Deharveng, 1991\*

Tijdschr. Ent. 134 (2): 145.



Type species: *C. asiaticus* Bedos & Deharveng, 1991, l.c., by original designation. *M*

*Chaetobella* Cassagnau, 1983\*

Nouv. Revue Ent. 13 (1): 16, 19.

Type species *Lobella* (*Propeanura*) *numatai* Yosii, 1966, by original designation. *F*

*Chaetophorura* Rusek, 1976

Note: This name was misspelled '*Chaetaphorura*' in the first supplement (p.4).

*Chihuahuachorutes* Palacios-Vargas, 1990\*

Folia ent. mex. 79: 7.

Type species: *C. escobarae* Palacios-Vargas, 1990, l.c., by original designation. *M*

*Chirolavia* Deharveng, 1991\*

Raffles Bull. Zool. 39 (1): 54.

Type species: *C. murphyi* Deharveng, 1991, l.c., by original designation. *F*

*Chribellphorura* Weiner, 1996\*

Annls Soc. ent. Fr. (N. S.) 32 (2): 174.

Type species: *Onychiurus* (*Archaphorura*) *allanae* Christiansen & Bellinger, 1980, by original designation. *F*

*Christobella* Fjellberg, 1985\*

Ent. scand. Suppl. 21: 116.

Type species: *Neanura ornata* Folsom, 1902, by original designation. *F*

*Cinctocyrtus* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 44, ut subgenus *Ascoecyrtus* Yosii, 1963.

Type species: *Lepidocyrtus cinctus* Schäffer, 1898, by original designation. *M*

See note on authorship under *Allocyrtus*, above.

*Coenaletes* Bellinger, 1985\*

Carib. J. Sci. 21 (3/4): 118.

Type species: *Actaletes vangoethemi* Jacquemart, 1980, by original designation. *M*

*Cordobaia* Simón, Bach, & Gaju, 1987\*

Eos 62 (1/4): 303.

Type species: *C. bembazarensis* Simón, Bach, & Gaju, 1987, l.c., by original designation. *F*

*Coreanura* Deharveng & Weiner, 1984\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 4(4): 27.

Type species: *C. filiae* Deharveng & Weiner, 1984, l.c., by monotypy. *F*

*Cribrochiurus* Weiner, 1996

Annls Soc. ent. Fr. (N.S.) 32(2): 189.

Type species: *Onychiurus cribrerosus* Gisin, 1957, by original designation. *M*

Note: as mentioned here by Weiner, and by Ellis & Bellinger (1973), the name *Cribrochiurus* was proposed by Palissa (1964) without a type species; the name was therefore unavailable at that time.

*Cyprania* Bretfeld, 1992\*

Mitt. zool. Mus. Kiel, Suppl. 4: 45.

Type species: *C. gisae* Bretfeld, 1992, l.c., by original designation. *F*

*Dablcyrus* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 44,55, ut subgenus *Ascoecyrtus* Yosii, 1963.

Type species: *Lepidocyrtus dahlui* Schäffer, 1898, by original designation. *M*

See note on authorship under *Allocyrtus*, above.

*Deboutevillea* Murphy, 1965

Incorrect original spelling (genus named for C. Delamare Deboutteville) of *Debouttevillea* Murphy, 1965.

Unavailable name.

*Deharvengiurus* Weiner, 1996\*

Annls Soc. ent. Fr. (N. S.) 32 (2): 183.

Type species: *Onychiurus argus* Denis, 1924, by original designation. *M*

*Deuteraphorura* Absolon, 1901

Note: Weiner, 1996, Annls Soc. ent. Fr. (N. S.) 32 (2): 184, states that the type of this genus is '*Onychiurus fimetarius* (L.) (auct.) Stach, 1934', by Stach's designation [in 1954]. This is contrary to the selection by Ellis & Bellinger, 1973, of *Onychiurus ambulans* (L.). The implications of this statement are complex and will be treated elsewhere.

*Deuterobella* Yoshii & Suhardjono, 1992\*

Acta zool. Asiae orient. 2: 5, ut subgenus *Lobella* Börner, 1906.

Type species: *L. imadatei* Yosii, 1976, by original designation. *F*

*Digitanura* Deharveng, 1987\*

Bull. Annls Soc. r. belge Ent. 123(4/6): 125.

Type species: *D. quadrilobata* Deharveng, 1987, l.c., by original designation. *F*

*Elgonura* Cassagnau, 1984\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 4(3): 5.

Type species: *E. erinacea* Cassagnau, 1984, l.c., by original designation. *F*

*Fissuraphorura* Rusek, 1991\*

Acta ent. bohemoslov. 88: 145.

Type species: *F. cubanica* Rusek, 1991, l.c., by original designation. *F*

*Folsomia* Willem, 1902

Add to entry:

The genus and its type species, *F. candida*, were placed on the respective official lists by Opinion 1421, in connection with the suppression of the name *Entomobrya cavicola* Banks, 1897, a senior subjective synonym of *candida*.

*Formosanochiurus* Weiner, 1986\*

2<sup>nd</sup> internat. Sem. Apterygota: 93.

Type species: *Onychiurus formosanus* Denis, 1929, by original designation. *M*

*Ghirkanura* Kuznetsova & Potapov, 1988\*

Zool. Zhurn. 67 (12): 1839.

Type species: *G. chernovae* Kuznetsova & Potapov, 1988, l.c., by original designation. *F*

*Gnathofolsomia* Deharveng & Christian, 1984\*

Verh. zool.-bot. Ges. Österreich 122: 97.

Type species: *G. palpata* Deharveng & Christian, 1984, l.c., by original designation. *F*

*Haloxenylla* da Gama & Deharveng, 1984\*

Bull. Soc. Hist. nat. Toulouse 120: 131.

Type species: *Xenylla affiniformis* Stach, 1929, by original designation. *F*

*Hazaranura* Cassagnau, 1991\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 6(4): 16.

Type species: *H. elongata* Cassagnau, 1991, l.c., by original designation. *F*

*Hemilobella* Deharveng & Greenslade, 1992\*

Invert. Taxon. 6 (3): 729.

Type species: *H. rounsevelli* Deharveng & Greenslade, 1992, l.c., by original designation. *F*

*Himalmeria* Cassagnau, 1984\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 4(3): 4.

Type species: *H. (H.) gurung* Cassagnau, 1984, l.c., by original designation. *F*

*Hyperlobella* Cassagnau, 1988\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 5(4): 22, 24.

Type species: *Protanura kraepelini* Börner, 1906, by original designation. *F*

*Intermediurida* Najt, Thibaud & Weiner, 1990\*

Bull. Mus. natl Hist. nat. Paris (4)12A (1): 95, 114.

Type species: *I. anophthalma* Najt, Thibaud & Weiner, 1990, l.c., by original designation. *F*

*Irianella* Yoshii & Suhardjono, 1992\*

Acta zool. Asiae orient. 2: 41, ut subgenus *Pseudoparonella* Handschin, 1925.

Type species: *P. (I.) balmaherae* Yoshii & Suhardjono, 1992, l.c., by original designation. *F*

*Isotogastrura* Thibaud & Najt, 1992\*

Bonner zool. Beitr. 43 (4): 545.

Type species: *I. arenicola* Thibaud & Najt, 1992, l.c., by original designation. *F*

*Jailolaphorura* Yoshii & Suhardjono, 1992\*

Acta zool. Asiae orient. 2: 9, ut subgenus *Onychiurus* Gervais. 1841.

Type species: *O. (J.) jailolonis* Yoshii & Suhardjono, 1992, l.c., by original designation. *F*

*Javaphysa* Yoshii, 1992\*

Mem. Mus. Victoria 53: 131, ut subgenus *Callyntrura* Börner, 1906.

Type species: *C. (J.) javana* Yoshii, 1992, l.c., by original designation. *F*

*Koreanurina* Najt & Weiner, 1992\*

Pan-Pacif. Ent. 68 (3): 200.

Type species: *K. szeptyckii* Najt & Weiner, 1992, l.c., by original designation. *F*

*Lanocyrtus* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 44, 58, ut subgenus *Lepidocyrtus* Bourlet, 1839.

Type species: *Podura lanuginosa* Gmelin, 1790, by original designation. *M*

*Lanzhotia* Rusek, 1985\*

Acta ent. bohemoslov. 82 (3): 175.

Type species: *L. brachycera* Rusek, 1985, l.c., by original designation. *F*

*Lasofinius* Ireson & Greenslade, 1990\*

J. Aust. ent. Soc. 29: 205.

Type species: *L. willi* Ireson & Greenslade, 1990, l.c., by original designation. *M*

*Lawrenceana* Mitra, 1993\*

Rec. zool. Survey India, Occ. Pap. 154: 34.

No species included.

Unavailable name.



*Leenurina* Najt & Weiner, 1992\*

Pan-Pacif. Ent. 68 (3): 203.

Type species: *L. jasii* Najt & Weiner, 1992, l.c., by original designation. *F**Linasa* nom. nov.\*New name for *Silana* Yoshii & Suhardjono, 1992, nec Spaeth, 1914.Type species: *Salina* (*Silana*) *moluccana* Yoshii & Suhardjono, 1992. *F**Madecassiella* Betsch & Waller, 1996\*

Bull. Soc. ent. Fr. 101 (4): 416.

Type species: *M. ibityensis* Betsch & Waller, 1996, by original designation. *F**Marginobrya* Yoshii, 1992\*Acta zool. Asiae orient. 2: 100, ut subgenus *Entomobrya* Rondani, 1861.Type species: *E. (M.) marginifera* Yosii, 1992, l.c., by original designation. *F**Merapicyrtus* Yoshii & Suhardjono, 1992\*Acta zool. Asiae orient. 2: 82, ut subgenus *Ascocyrtus* Yosii, 1963.Type species: *A. (M.) merapicus* Yoshii & Suhardjono, 1992, l.c., by original designation. *M**Mexicanura* Palacios-Vargas, 1984

An. Esc. nac. Cienc. biol. Mex. 27: 69.

*Lapsus calami* for *Americanura* Cassagnau, 1983.

Unavailable name.

*Monolamellus* Lee, 1979\*Korean J. Ent. 9 (2); 5, ut subgenus *Tomocerus* Nicolet, [1842].Type species: *Tomocerus laxalamella* Lee, 1975, by monotypy.Published without diagnosis in the combination *T. (M.) laxalamella*, nomen nudum.

Unavailable name.

*Mucrella* Fjellberg, 1985\*Ent. scand. Suppl. 21:12, ut subgenus *Hypogastrura* Bourlet, 1839.Type species: *H. (M.) denali* Fjellberg, 1985, l.c., by original designation. *F**Multivesicula* Rusek, 1982\*

Vestn. cesk. Spol. zool. 46(1): 33.

Type species: *M. columbica* Rusek, 1982, l.c., by original designation. *F**Nabuanura* Palacios-Vargas & Najt, 1986\*

Folia ent. mex. 68: 18.

Type species: *N. ce* Palacios-Vargas & Najt, 1986,l.c., by original designation. *F**Najtia* Arlé & Mendonça, 1986\*

Revista bras. Ent. 30(1): 1.

Type species: *Isotoma vicaria* Arlé, 1959, by original designation. *F**Najtiaphorura* Weiner & Thibaud, 1991\*

Bull. Mus. natl Hist. nat. Paris (4) 13A (1-2): 113.

Type species: *N. sandrinae* Weiner & Thibaud, 1991, l.c., by original designation. *F**Najtnella* Yosii, 1989\*Contr. biol. Lab. Kyoto Univ. 27 (3): 249, ut subgenus *Pseudoparonella* Handschin, 1925.Type species: *P. novaecaledoniae* Yosii, 1960, by original designation. *F**Najtsira* Yosii, 1989\*Contr. biol. Lab. Kyoto Univ. 27 (3): 236, ut subgenus *Lepidosira* Schött, 1925.Type species: *L. (N.) najtae* Yoshii, 1989, l.c., by original designation. *F**Narisa* Yoshii & Suhardjono, 1992\*Acta zool. Asiae orient. 2: 37, 38, ut subgenus *Salina* MacGillivray, 1894Type species: *S. pallens* Yoshii, 1984, by original designation. *F*[ *Nasopus* Richards, 1956\* ]

Thesis: 86.

Type species: *Smynthurus spinatus* MacGillivray, 1893, by original designation. *M*Unpublished objective synonym of *Pseudo-bourletiella* Stach, 1956. Unavailable name.*Neokatianna* Snider, 1989\*Florida Ent. 72 (3): 541, ut subgenus *Sminthurinus* Börner, 1901.Type species: *S. (N.) acantholaema* Snider, 1989, l.c., by original designation. *F**Nepalimeria* Cassagnau, 1984\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 4 (3): 1, 3, 5.

Type species: *N. dal* Cassagnau, 1984, l.c., by original designation. *F**Nusasira* Yoshii & Suhardjono, 1989\*Acta zool. Asiae orient. 1: 38, ut subgenus *Lepidosira* Schött, 1925.Type species: *Pseudosira (Mesira) javana* Börner, 1913, by original designation. *F*See note on authorship under *Alloocyrtus*, above.

*Oceaniella* Yoshii, 1989\*

Contr. biol. Lab. Kyoto Univ. 27 (3): 261, ut subgenus *Pseudoparonella* Handschin, 1925.

Type species: *P. (O.) najtae* Yoshii, 1989, l.c., by original designation. *F*

*Octodontophora* Chelnokov, 1990\*

Ent. Obozr. 69 (2): 343.

Type species: *O. ornata* Chelnokov, 1990, l.c., by original designation. *F*

*Onerocyrtus* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 44, 45, ut subgenus *Acrocyrtus* Yosii, 1959.

Type species: *Lepidocyrtus onerosus* Yoshii, 1982, by original designation. *M*

See note on authorship under *Allocyrtus*, above.

*Ongulogastrura* Thibaud & Massoud, 1983\*

Mém. biospéol. 10: 317.

Type species: *O. longisensilla* Thibaud & Massoud, 1983, l.c., by original designation. *F*

*Ongulonychiurus* Thibaud & Massoud, 1986\*

Bull. Mus. natl Hist. nat. Paris (4) 8A (2): 327.

Type species: *O. colpus* Thibaud & Massoud, 1986, l.c., by original designation. *M*

*Orchesella* Templeton, 1835

Trans. ent. Soc. London 1 (2): 92.

Type species: *O. filicornis* Templeton, 1835, by subsequent designation by Rothschild, 1878, Musée entomologique illustré 3: 365. *F*

Note: the type designation by Rothschild antedates that of *O. cincta* by Börner, 1903, cited in the List, p. 37. Fortunately *O. filicornis* and *O. cincta* are generally regarded as synonymous. In reply to an inquiry to the International Commission we are informed that the citation of type species for *Orchesella* on the Official List has been altered to read '*Orchesella filicornis* Templeton, 1835 = *O. cincta* (Linnaeus, 1758)'.

Placed on the Official List of Generic Names in Zoology: 723, Opinion 291.

*Palaeosminthurus* Pierce & Gibrion, 1962

Note: according to Najt, 1987, Revue fr. Ent. (N. S.) 9: 152, the type and only included species, *P. juliae*, belongs to Formicidae rather than Collembola.

*Paracerura* Deharveng & Oliveira, 1994\*

Revue suisse Zool. 101 (2): 442.

Type species: *P. virgata* Deharveng & Oliveira, 1994, l.c., by original designation. *F*

*Paralobella* Cassagnau & Deharveng, 1984\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 5 (1): 9.

Type species: *P. orousseti* Cassagnau & Deharveng, 1984, l.c., by original designation. *F*

*Paramanura* Cassagnau, 1986\*

2<sup>nd</sup> int. Sem. Apterygota: 315.

Type species: *P. najtae* Cassagnau, 1986, l.c., by original designation. *F*

*Paranurida* Skarzynski & Pomorski, 1994\*

Genus 5 (4): 363.

Type species: *P. kopetdagi* Skarzynski & Pomorski, 1994, l.c., by original designation. *F*

*Parectonura* Deharveng, 1988\*

Mém. Mus. natl Hist. nat. Paris (A) 152: 46.

Type species: *P. ciliata* Deharveng, 1988, l.c., by original designation. *F*

*Parthenaphorura* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 31, ut subgenus *Onychiurus* Gervais, 1841.

Type species: *O. (P.) bogoriensis* Yoshii & Suhardjono, 1989, l. c., by original designation. *F*

See note on authorship under *Allocyrtus*, above.

*Pecten isotoma* Gruia, 1983\*

Rés. Expéd. biospéol. cubano-roum. 4: 193.

Type species: *P. theodori* Gruia, 1983, l.c., by original designation. *F*

*Penelopella* Cassagnau, 1986\*

2<sup>nd</sup> int. Sem. Apterygota: 315.

Type species: *P. pacifica* Cassagnau, 1986, l.c., by original designation. *F*

*Philotella* Najt & Weiner, 1985\*

Annls Soc. ent. Fr. 21 (1): 29.

Type species: *P. deharvengi* Najt & Weiner, 1985, l.c., by original designation. *F*

*Phradmon* Greenslade & Deharveng, 1991\*

Invert. Taxon. 5 (4): 840.

Type species: *P. australasiae* Greenslade & Deharveng, 1991, l.c., by original designation. *M*

*Plumosinella* Gruia, 1984\*

Trav. Inst. Spéol. 'Emil Racovitza' 23: 21, ut subgenus *Pseudosinella* Schäffer, 1897.

Type species: *Pseudosinella (P.) kenchristianseni* Gruia, 1984, l.c., by original designation. *F*

*Pongeiella* Rusek, 1991\*

Acta Soc. zool. bohemoslov. 55: 65.

Type species: *Tullbergia (T.) falca* Christiansen & Bellinger, 1980, by original designation. *F*



*Probrachystomellides* Weiner & Najt, 1991\*

Bonner zool. Beitr. 42 (3/4): 376.

Type species: *P. nicolaii* Weiner & Najt, 1991, l.c., by original designation. *M**Psammisotoma* Greenslade & Deharveng, 1986\*

Proc. R. Soc. Queensland 97: 89.

Type species: *P. kingae* Greenslade & Deharveng, 1986, l.c., by original designation. *F**Psammophorura* Thibaud & Weiner, 1994\*

Polskie Pismo ent. 63: 8.

Type species: *P. gedanica* Thibaud & Weiner, 1994, l.c., by original designation. *F**Pseudoxenyllodes* Kuznetsova & Potapov, 1988\*Zool. Zhurn. 67 (12): 1833, ut subgenus *Xenyllodes* Axelson, 1903.Type species: *X. (P.) macrocanthus* Kuznetsova & Potapov, 1988, l.c., by original designation. *M**Rambutanura* Deharveng, 1988\*

Can. J. Zool. 66 (3): 714.

Type species: *R. yoshii* Deharveng, 1988, l.c., by original designation. *F**Rambutsinella* Deharveng & Bedos, 1996\*

Raffles Bull. Zool. 44 (1): 280.

Type species: *R. honchongensis* Deharveng & Bedos, 1996, l. c., by original designation. *F**Raponella* Najt, 1988\*

Nouv. Revue Ent. (N. S.) 5 (3): 205.

Type species: *Probrachystomella dodecophthalma* Najt, 1988, l.c., by original designation. *F**Rotundiphorura* Rusek, 1991\*

Acta ent. bohemoslov. 88: 152.

Type species: *R. habanica* Rusek, 1991, l.c., by original designation. *F**Rusekella* Deharveng, 1982\*

Bull. Soc. Hist. nat. Toulouse 118: 235.

Type species: *R. cantabrica* Deharveng, 1982, l.c., by original designation. *F**Sabacanthella* Potapov & Stebaeva, 1994\*

Misc. zool. 17: 135.

Type species: *S. kele* Potapov & Stebaeva, 1994, l.c., by original designation. *F**Salvarella* Greenslade & Najt, 1987\*

Revue fr. Ent. (N.S.) 9(3): 115.

Type species: *S. wallacei* Greenslade & Najt, 1987, l.c., by original designation. *F**Secotomodes* Potapov, 1988\*

Zool. Zhurn. 67 (1): 144.

Type species: *S. sibiricus* Potapov, 1988, l.c., by original designation. *M**Sericeotoma* Potapov, 1991\*Acta zool. cracov. 34 (1): 287, ut subgenus *Isotoma* Bourlet, 1839.Type species: *I. (S.) knissi* Potapov, 1991, l.c., by original designation. *F**Siamanura* Deharveng, 1987\*

Trav. Lab. Ecobiol. Arthr. édaph. Toulouse 5 (2): 1, 2.

Type species: *S. clavata* Deharveng, 1987, l.c., by original designation. *F**Sibiracanthella* Potapov & Stebaeva, 1994\*

Misc. zool. 17: 130.

Type species: *S. nuda* Potapov & Stebaeva, 1994, l.c., by original designation. *F**Sibirisotoma* Rusek, 1991\*

Acta ent. bohemoslov. 88: 33.

Type species: *S. stebajevae* Rusek, 1991, l.c., by original designation. *F**Silana* Yoshii & Suhardjono, 1992\*Acta zool. Asiae orient. 2: 28, ut subgenus *Salina* MacGillivray, 1894; nec Spaeth, 1914, Deutsche ent. Ztg. 1914: 563 (Coleoptera).Type species: *Salina (Silana) moluccana* Yoshii & Suhardjono, l.c., by original designation. *F*Note: the spelling *Sirana* on p. 40 is an obvious *lapsus calami*, but in any case is preoccupied by *Sirana* Griveaud, 1975, Bull. Soc. ent. Fr. 807/8): 232 (Lepidoptera).Junior homonym; replaced by *Linasa* nom. nov.*Singalimeria* Cassagnau, 1984\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 4(3): 1, 3, 5.

Type species: *S. pachyderma* Cassagnau, 1984, l.c., by original designation. *F**Sinnamarides* Betsch, 1991\*

Revue Ecol. Biol. Sol 28 (2): 230.

Type species: *S. delamarei* Betsch, 1991, l.c., by original designation. *F**Speleophysa* Bagnall, 1969\*

In Glennie, Trans. Cave Res. Group Great Britain 11(2): 107. Nomen nudum.

Type species: *S. varioseta* Bagnall, 1969, l.c., by monotypy. Nomen nudum. *F*

Unavailable name.

*Spinactaletes* Soto Adames, 1989\*

Carib. J. Sci. 24 (3/4): 174.

Type species: *S. calcalectoris* Soto Adames, 1989, l.c., by original designation. *M*

[ *Spinaphorura* Arbea, 1987\* ]

Thesis [not seen]; Diss. Abs. int. C 49(2): 214 (1988).

Type species: ?*Spinaphorura clavata* Arbea, 1987. *F*

Note: according to Jordana et al., 1990, Publ. biol. Univ. Navarra, Ser. Zool.21:129, *Spinaphorura clavata* is a species of *Neonaphorura*.

Unpublished. Unavailable name.

*Spinonychiurus* Weiner, 1996\*

Annl. Soc. ent. Fr. (N. S.) 32 (2): 188.

Type species: *Onychiurus edinensis* Bagnall, 1935, by original designation. *M*

*Stenaphorurella* Lucifáñez & Simón, 1992\*

Eos 68(2): 108.

Type species: *Stenaphorura quadrispina* Börner, 1901, by original designation. *F*

*Stenomeria* Cassagnau, 1990\*

Annl. Soc. ent. Fr. (N. S.) 26 (1): 29.

Type species: *S. deharvengi* Cassagnau, 1990, l.c., by original designation. *F*

*Sturmius* Bretfeld, 1994\*

J. Zool. syst. Evol. Res. 32: 264.

Type species: *S. epiphytus* Bretfeld, 1994, l.c., by original designation. *M*

*Sundasira* Yoshii & Suhardjono, 1989\*

Acta zool. Asiae orient. 1: 38, ut subgenus *Lepidosira* Schött, 1925.

Type species: *L. (S.) sundana* Yoshii & Suhardjono, 1989, l.c., by original designation. *F*

See note on authorship under *Allocyrtus*, above.

*Tamulmeria* Cassagnau, 1988\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 5(5): 23, 26.

Type species *T. callipygos* Cassagnau, 1988, l.c., by original designation. *F*

*Tasphorura* Greenslade & Rusek, 1996\*

Syst. Ent. 21: 28.

Type species: *T. vesiculata* Greenslade & Rusek, 1996, l.c., by original designation. *F*

*Thibaudichiurus* Weiner, 1996\*

Annl. Soc. ent. Fr. (N. S.) 32 (2): 189.

Type species: *Onychiurus mariangeae* Thibaud & Lee, 1994, by original designation. *M*

*Tillieria* Weiner & Najt, 1991\*

Mém. Mus. natl. Hist. nat. Paris (A) 149: 123.

Type species: *T. insularis* Weiner & Najt, 1991, l.c., by original designation. *F*

*Tridontella* Stach, 1949

Apterygotan fauna of Poland 2, Neogastruridae and Brachystomellidae: 317.

Type species: *Odontella trispina* Womersley, 1935, by original designation.

This name was originally proposed, on p. 261 of the same volume, as *Triodontella*; the misspelling or variant spelling *Tridontella* appears on p. 317 and 340, as noted in the original List (p. 56). Since *Triodontella* Stach is a junior homonym of *Triodontella* Reitter, 1919, we proposed (1973, p. 7) the replacement name *Austrotridontella*. However, in the Nomenclator Zoologicus vol. 6 (1966), p. 300, the spelling *Tridontella* is treated as valid, with *Triodontella* noted as a variant spelling. According to one of the authors of this volume of the Nomenclator (M. Edwards, in litt.), any action taken beyond bibliographical listing was unintentional. The question of the validity of this and perhaps other names apparently validated in the Nomenclator has been called to the attention of the International Commission.

*Tritosminthurus* Snider, 1988\*

Ent. News 99(5): 260.

Type species: *T. schuhi* Snider, 1988, l.c., by original designation. *M*

[ *Trochopilosa* Richards, 1956\* ]

Thesis: 96, ut subgenus *Allacma* Börner, 1906.

Type species: *A. (T.) allacma* Richards, l.c., by original designation. *F*

Note: since Richards' thesis is technically unpublished, these names have no standing in nomenclature.

*Troglobius* Palacios-Vargas & Wilson, 1990\*

Int. J. Speleol. 19: 68.

Type species: *T. coprophagus* Palacios-Vargas & Wilson, 1990, l.c., by original designation. *M*

*Venezuelida* Diaz & Najt, 1995\*

Bull. Mus. natl. Hist. nat. Paris (4) 16A (2-4): 428.

Type species: *V. polylepiana* Diaz & Najt, 1995, l.c., by original designation. *F*

*Vietsira* Yoshii, 1994\*

Acta zool. Asiae orient. 3: 27.

Type species: *V. squamigera* Yoshii, 1994, l.c., by original designation. *F*



*Weinera* Thibaud, 1993\*

Revue fr. Ent. (N. S.) 15 (2): 73.

Type species: *W. ghislainae* Thibaud, 1993, l.c., by original designation. *F*

*Willemgastrura* Oliveira & Thibaud, 1988\*

Amazoniana 10 (3): 300.

Type species: *W. coeca* Oliveira & Thibaud, 1988, l.c., by original designation. *F*

*Yetimeria* Cassagnau, 1984\*

Trav. Lab. Écobiol. Arthr. édaph. Toulouse 4 (3): 1, 3, 4.

Type species: *Y. lama* Cassagnau, 1984, l.c., by original designation. *F*

*Zelandanura* Deharveng & Wise, 1987\*

Rec. Auckland Inst. Mus. 24: 143.

Type species: *Z. bituberculata* Deharveng & Wise, 1987, l.c., by original designation. *F*

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Ellis, W. N. & P. F. Bellinger, 1984. Generic names of Collembola: supplement 1973-1983. — Tijdschrift voor Entomologie 127 (1): 1-15.

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*allanae* Christiansen & Bellinger, 1980 (*Onychiurus* (*Archaphorura*)). — *Chribellphorura* Weiner, 1996  
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- stebaevae* Kuznetsova & Potapov, 1988 (*Caucasanura*). – *Caucasanura* Kuznetsova & Potapov, 1988
- stebajevae* Rusek, 1991 (*Sibirisotoma*). – *Sibirisotoma* Rusek, 1991
- subpolaris* Salmon, 1942 (*Anurophorus*). – *Antarctophorus* Potapov, 1992
- sundana* Yoshii & Suhardjono, 1989 (*Lepidosira* (*Sundasira*)). – *Sundasira* Yoshii & Suhardjono, 1989
- szczytyckii* Najt & Weiner, 1992 (*Koreanurina*). – *Koreanurina* Najt & Weiner, 1992
- theodori* Gruia, 1983 (*Pectenisotoma*). – *Pectenisotoma* Gruia, 1983
- tillierae* Deharveng, 1988 (*Caledonura*). – *Caledonura* Deharveng, 1988
- trispina* Womersley, 1935 (*Odontella*). – *Tridontella* Stach, 1949
- vangoethemi* Jacquemart, 1980 (*Actaletes*). – *Coenaletes* Bellinger, 1985
- [*varioseta* Bagnall, 1969 (*Speleophysa*). – *Speleophysa* Bagnall, 1969]
- vesiculata* Greenslade & Rusek, 1996 (*Tasphorura*). – *Tasphorura* Greenslade & Rusek, 1996
- vicaria* Arlé, 1959 (*Isotoma*). – *Najitia* Arlé & Mendonça, 1986
- virgata* Deharveng & Oliveira, 1994 (*Paracerura*). – *Paracerura* Deharveng & Oliveira, 1994
- wallacei* Greenslade & Najt, 1987 (*Salvarella*). – *Salvarella* Greenslade & Najt, 1987
- willi* Ireson & Greenslade, 1990 (*Lasofinius*). – *Lasofinius* Ireson & Greenslade, 1990
- yoshiana* Deharveng, 1988 (*Rambutanura*). – *Rambutanura* Deharveng, 1988

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## THE NEW *AURORA* SPECIES-GROUP OF THE GENUS *NEMOPHORA* HOFFMANNSEGG, WITH TWO NEW SPECIES FROM TAIWAN (LEPIDOPTERA, ADELIDAE)

Kozlov, M. V., 1997. The new *aurora* species-group of the genus *Nemophora* Hoffmannsegg, with two new species from Taiwan (Lepidoptera, Adelidae). – Tijdschrift voor Entomologie 140: 13-16, figs. 1-12 [ISSN 0040-7496]. Published 31 October 1997.

*Nemophora aurora* sp. n. and *N. uncella* sp. n. described from specimens collected in Taiwan form a monophyletic *aurora* species-group defined by two apomorphies: (1) dark brown lateral bands of forewing fascia with glossy silver-grey internal zone, (2) presence of small swelling bearing a tuft of long setae on oval depigmented spot at the base of valva in male genitalia. The *aurora* species-group is closely related to *degeerella* species-group.

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Key words. – Nemomorpha; Adelidae; taxonomy; Taiwan.

Most of the East Palaearctic and Oriental species of the genus *Nemophora* Hoffmannsegg, 1798, have never been critically examined since Meyrick's (1912) catalogue or their original description. This explains the fact that only three of *ca* 20 species of this genus collected in Taiwan are identified yet (Heppner 1992). Two further species of *Nemophora*, which presumably form a monophyletic unit introduced here as *aurora* species-group, are described below.

The male genitalia were investigated and figured as described by Kozlov (1993). The interocular index was measured according to Davis (1975), being the ratio between the vertical diameter of the compound eye and the interocular distance measured at a point of the frons midway between the base of the antennal sockets and the anterior tentorial pits. Recent locality names are added in square brackets, whenever possible.

The type specimens are deposited in the U. S. National Museum of Natural History, Smithsonian Institution, Washington, D. C., U.S.A. (USNM) and the National Museum of Natural Science in Taichung, Taiwan, China (NMNST).

### Taxonomic position of *N. aurora* and *N. uncella*

Two species described below share the following

characters with *degeerella* species-group: (1) Background forewing colour yellow to pale ochreous; (2) Dark forewing pattern with predominance of longitudinal stripes; (3) Forewing fascia consists of tree bands, the medial one being of the same colour as forewing background; (4) Basal part of forewing with characteristic pattern formed by silver-grey, dark brown bordered longitudinal stripes along costa, M and CuP veins, with some additional dark brown lines between these stripes.

The phylogenetic significance of these traits is not completely clear yet, and it can hardly be refined before the majority of *Nemophora* species is revised. However, characters 1 to 4 are regarded as apomorphies; among them, character 4 is presumably autapomorphic for the *aurora* and *degeerella* species-groups.

Monophyly of the *aurora* species-group is supported by the following synapomorphies: (5) Lateral bands of forewing fascia dark brown, with internal zone formed by silver-grey glossy scales; (6) Valva medially with small basal swelling bearing a tuft of long setae on small oval depigmented spot. Independent appearance of character (6) was reported for *N. ichnodesma* (Meyrick) (Kozlov 1995).

# Key to the species based on external characters and male genitalia

1. External silver-grey band in forewing fascia complete; vinculum short ( $< 3 \times$  length of valva); medial margin of valva distally without prominent lobe appearing laterally as a triangular protuberance ..... *aurora*
- External silver-grey band in forewing fascia broken in the middle, and part adjacent to the costal margin is hook-shaped in such a way that its distal part is parallel to the costal margin; this distal part in some specimens is separated from the base and forms a distinct spot; vinculum long ( $> 3 \times$  length of valva); medial margin of valva distally with prominent lobe appearing laterally as a triangular protuberance ..... *uncella*

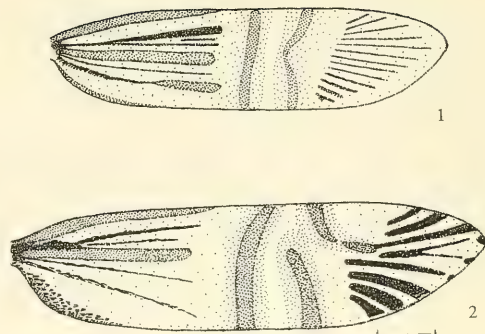
## *Nemophora aurora* sp. n.

(figs. 1, 3 - 7)

Type material. - Holotype ♂: Taiwan, Tyokakurai, 26.III.1944, S. Issiki (Issiki Collection, USNM). - Paratypes: 3♂, same data as holotype. 2♂, 1♀, Taiwan, Baibara [? Nantou Co., Hsinseng], 24.III.1943, S. Issiki. 1♀, labelled as previous, except for date '25.III.1943'. 1♀, labelled as previous, except for date '27.III.1943'. 1♀, Taiwan, Tattaka [Nantou Co., Tatachia], 7.VI.1943, S. Issiki. 2♂, Taiwan, Musya [? Nantou Co., Lenai], 27.III.1943, S. Issiki. 1♂, Taiwan, E.VII.1947, Chingsing Li (all in Issiki Collection, USNM). 1♂, 2♀, Taiwan, Natou Co., Jean-ai, Songgang, 14.IV.1996, S. H. Yen (NMNST).

## Description

Male. Forewing length 6.7-7.4 mm; wing expanse 14-15 mm. Vertex yellow, with admixture of brown hair-like scales; frons yellow. Compound eyes not enlarged (interocular index 0.6). Proboscis brownish yellow, base covered with yellow scales. Labial palpus long (about  $1.6 \times$  vertical eye diameter), yellow, with brown tip and brown raised hair-like scales. Antenna  $3.5 \times$  forewing length, with simple inwardly directed pegs on basal flagellar segments; scapus and base of flagellum brown, then the colour of flagellum changes clinally to grey. Tegula and thorax (dorsum) bronze. Forewing (fig. 1) yellowish ochreous, glossy bronze; basal area with three silver stripes (along costal, medial and postcubital veins) and some four or five dark brown lines. Apical quarter of forewing with numerous (10 to 14) narrow dark brown radial lines; in melanic specimens dark lines wide, creating impression of narrow yellow lines on dark brown background. Medial band of fascia yellow, bordered on both sides by wide ochreous bands with diffuse margins; central zone of these bands with



Figs. 1-2. *Nemophora*, forewing pattern. - 1, *N. aurora*; 2, *N. uncella*. Scale 1.0 mm.

glossy silver-grey zone. Internal margin of the proximal ochreous band straight, almost indistinct from the ochreous background; external margin of the distal ochreous band convex in middle of forewing. Cilia bronze. Hindwing base grey, apex brown, glossy purplish; costal area light grey; cilia grey to bronze. Legs yellowish-brown to brown; tibia and all tarsomeres apically with yellow rings. Epiphysis at 1/2 of fore tibia, almost reaching its tip. Abdomen brown.

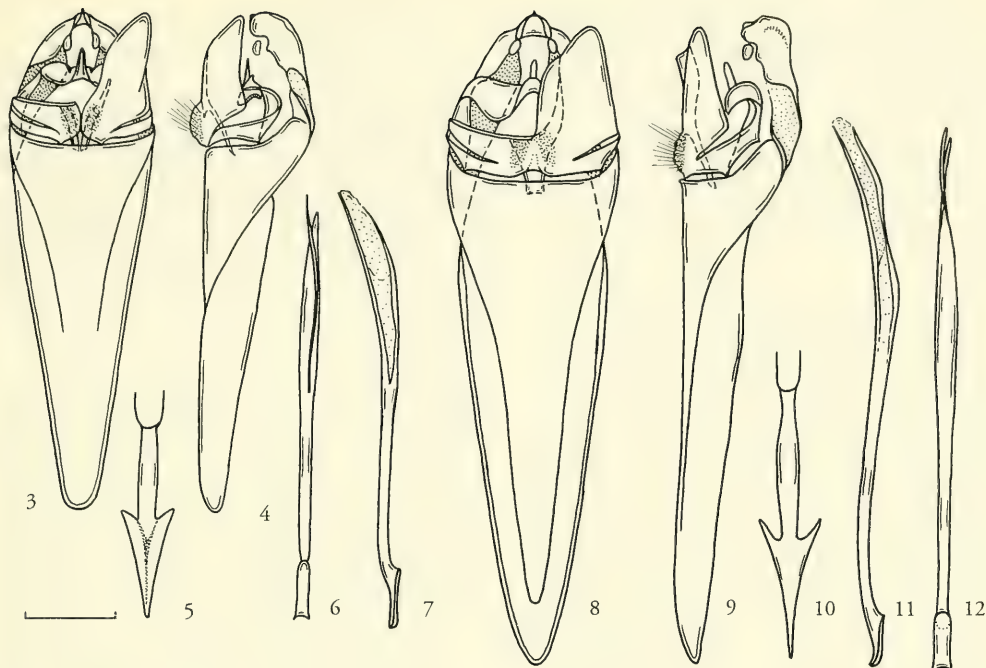
Female. Forewing length 6.0-6.2 mm; wing expanse 12.5-13.2 mm. Antenna  $1.4 \times$  forewing, brown; scapus and base of flagellum glossy purplish. Otherwise similar to male.

Male genitalia (figs. 3-7). Tegumen dome-shaped, with sharp medial ridge. Socii elongate, about same diameter as medial part of aedeagus. Vinculum with straight lateral margins, tip rounded. Length of valva c.  $0.35 \times$  length of vinculum. Medial margin of valva ventrally with emargination at 0.4 valvar length; tip narrowly rounded. Valva medially with small ( $1/3 \times$  length of valva, in lateral view); basal swelling bearing tuft of long setae on small oval depigmented spot. Valvae not accreted basally. Arrow-head of juxta narrow (width about  $1/2 \times$  length), tip of arrow-head pointed. Distal half of aedeagus membranous, with two slightly curved narrow sclerotized bands; aedeagus basally of the same width as medially.

## Biology

Moths were collected in the evergreen forest dominated by oak (*Quercus* spp.), with admixture of *Litsea acuminata*, *Cinnamomum* spp., *Castanopsis formosana*, *Ilex* spp., *Acer kawakamii* and *Lithocarpus* spp. Moths fly very high above the canopy layer; maximum activity occurred at 9 - 10 a. m. (S. H. Yen, pers. comm.).





Figs. 3-12. *Nemophora*, male genitalia. – 3, *N. aurora*, genital complex, ventral view; 4, same, genital complex, lateral view; 5, same, juxta; 6, same, aedeagus, ventral view; 7, same, aedeagus, lateral view; 8, *N. uncella*, genital complex, ventral view; 9, same, genital complex, lateral view; 10, same, juxta; 11, same, aedeagus, ventral view; 12, same, aedeagus, lateral view; scale 0.25 mm.

*Nemophora uncella* sp. n.  
(figs. 2, 8-12)

Type material. – Holotype ♂: Taiwan, Hassenran [? Taichung Co., Pahsienshan], 24.x.1929, S. Issiki (Issiki Collection, USNM). Paratypes: 2♂, 1♀, labelled as holotype (Issiki Collection, USNM). 1♂, Taiwan, Syōrei, 12.viii.1943, A. Mutuura (Issiki Collection, USNM). 2♂, Taiwan, Hnalien Co., Tayulin-Tzer-en, 15.vii.1995, S. H. Yen (NMNST). 1♂, Taiwan, Natou Co., Jean-ai, Songgang, 14.iv.1996, S. H. Yen (NMNST). 2♀, Taiwan, Taichung Co., Hoping, An-ma-shan, 1800 m, 23.iii.1996, S. H. Yen (NMNST). 1♀, Taiwan, Kaohsiung Co., Maoling, Teng-Jur Area, 2200 m, 15-15.iv.1996, W. Y. Chou (NMNST).

**Description**

Male. Forewing length 8.2-8.7 mm; wing expanse 17-18 mm. Vertex yellow, with sparse brown hair-like scales; frons straw-yellow. Compound eyes not enlarged (interocular index 0.6). Proboscis yellow, with two lines of brown scales on the base of frontal surface. Labial palpus long (about  $1.8 \times$  vertical eye diameter), straw-yellow, tip dorsally brown. Antenna

$3.8-4.1 \times$  forewing length, with simple inwardly directed pegs on basal flagellar segments; scapus and basal half of flagellum dark brown, glossy purplish, then colour of flagellum changes clinally to bronze. Tegula and thorax (dorsum) bronze, glossy gold. Forewing (fig. 2) straw-yellow; basal area with silver stripes (along costal and medial veins) and some four or five dark brown lines; dorsal margin dark in the basal one-third of the wing. Apical quarter with 7 to 9 suffuse dark brown radial lines; these lines are much shorter near costal margin than near ventral one. Medial band of fascia yellow, bordered on both sides by wide ochreous bands with diffuse margins; central zone of these bands with glossy silver-grey zone. Internal margin of the proximal ochreous band slightly convex, almost indistinct from the ochreous background. The silver-grey zone of distal band consists of two parts: the costal one turns towards the apex of the wing, forming a hook, whereas the dorsal part is slightly turned towards the wing base. Distal part of the dorsal hook-like strip in some specimens is isolated in a form of the elongate spot. Cilia bronze. Hindwing brown, slightly darker apically; costal area grey; cilia greyish-brown to brown. Legs yellow ven-

trally and brown dorsally, except for apical parts of tibia and tarsomeres which are yellow on both sides. Epiphysis at 1/2 of fore tibia, not reaching its tip. Abdomen brown dorsally, yellow ventrally.

Female. Forewing length 8.0 mm; wing expanse 16.5 mm. Antenna 1.5  $\times$  forewing, brown; scapus and basal one-third of flagellum with appressed dark brown, glossy purplish scales. Otherwise similar to male.

Male genitalia (figs. 8-12). Tegumen dome-shaped, with sharp medial ridge. Socii elongate, about same diameter as medial part of aedeagus. Vinculum with straight lateral margins, tip almost pointed. Length of valva c. 0.30  $\times$  length of vinculum. Medial margin of valva ventrally with prominent lobe appearing laterally as a triangular protuberance; tip of valva widely rounded. Valva medially with small ( $< 1/3 \times$  length of valva, in lateral view) basal swelling bearing tuft of long setae on small oval depigmented spot. Valvae accreted basally. Arrow-head of juxta narrow (width about  $1/2 \times$  length), tip of arrow-head pointed. Distal one-third of aedeagus membranous, with two slightly curved narrow sclerotized bands; aedeagus basally of the same width as medially.

## Biology

For habitat characteristics, see *N. aurora*. Moths fly in the canopy and subcanopy layers, 7 - 20 m above the ground; maximum activity occurred at 9-10 a. m. and 15-16 p. m. Moths were observed feeding on flowers of *Lithocarpus formosana*, *L. kawakamii* and *Castanopsis longicaudata* (S. H. Yen, pers. comm.).

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# TEN NEW SPECIES OF *RHAGOVELIA* (HETEROPTERA: VELIIDAE) FROM SULAWESI (INDONESIA).

Notes on Malesian aquatic and semiaquatic bugs (Heteroptera), VII

Nieser, N., H. Zettel & P. P. Chen, 1997. Ten new species of *Rhagovelia* (Heteroptera: Veliidae) from Sulawesi. Notes on Malesian aquatic and semiaquatic bugs (Heteroptera), VII. – Tijdschrift voor Entomologie 140: 17–41, figs. 1–45 [ISSN 0040-7496]. Published 31 October 1997.

Ten new species of *Rhagovelia* from the province of Sulawesi are described: *R. abra*, *R. gyrasta*, *R. krama*, *R. ochra*, *R. ptychona*, *R. sterea* from the main island of Sulawesi, *R. abra* from Togian Island, *R. cylindros* and *R. skoura* from Sangihe Island and *R. tsouloufi* from Salibabu and Taulaud Islands. Two new species groups, the *R. gyrasta*- and *R. ptychona*-groups are erected, some species are transferred to other groups and the species groups in the area are redefined. Some additional records for several species, a check-list and keys to species groups and species of *Rhagovelia* for the Sulawesi area are also given.

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Key words. – Sulawesi, Sangihe I.; Talaud I.; Togian I.; Veliidae, *Rhagovelia*, key, new species, new species groups.

The ten species of *Rhagovelia* Mayr, 1865, described below have partly been collected on islands belonging to the provinces of Sulawesi Utara and Sulawesi Tengah. Three species belong to a small collection of aquatic bugs made by the first author in the Sangihe-Talaud group. The fourth is based on a few specimens collected on the Togian group which belongs to Sulawesi Tengah which were in the NHMW. In addition there are six new species and additional records from the main island of Sulawesi collected by J. P. & M. J. Duffels (ZMAN) and J. van Tol (RMNH). So all localities are within the administrative entity Sulawesi of the Republic of Indonesia. As there is at present great interest in the taxonomy and biogeography of Australasian Rhagoveliinae (Polhemus & Polhemus 1988, Lansbury 1993, Nieser & Chen 1994, Yang & Polhemus 1994, Zettel 1994, 1995) it was decided to publish the descriptions of these species in advance of a report on the Sangihe-Talaud collection. The Sulawesi area seems to be especially rich in species, in ten years of collecting (1985–1994) 29 species have been discovered.

Measurements are in mm, angles in radians. Measurements have been based, when sufficient specimens available, on five specimens of each sex and

morph, preferably from the sample containing the holotype. Measurements refer to the maximum value and have been taken with the axis along which the body or body part is measured in a horizontal plane. The width of a leg segment is its maximum width measured to the bases of eventual teeth or spines, length of a leg segment is measured to the tip of eventual apical teeth or spurs. The presentation of measurements may vary in the number of digits behind the decimal point. This is on purpose, the same part of the body may in one species display more variation than the next so 0.2 (0.15–0.25) can be found next to 0.20 (0.195–0.205). Distinction is sometimes made between macropterous (with complete wings) and dealate (with wings partly or nearly entirely torn off) as the frequency of the dealate condition differs between species and species groups. However, dealate specimens are cited as macropterous in the records of material.

Locality indications between braces, {}, are not on the labels but have been added by the authors as explanation.

Specimens have been deposited in the following collections: 1) registered in Arnett et. al. (1993): BMNH (London, U. K.), MBBJ (Bogor, Indonesia),

JTPC (Englewood, Co. U.S.A.), MUDH (The Hague, The Netherlands), NHMW (Vienna, Austria), OXUM (Oxford, U. K.), RMNH (Leiden, The Netherlands), SEMC (Snow Entomological Museum, Lawrence, Kansas, U.S.A.), USCP (Cebu, Philippines), ZMAN (Amsterdam, The Netherlands). Not registered: NCTN (Nieser Collection, Tiel, The Netherlands).

#### ACKNOWLEDGEMENTS

Thanks are due to Drs. J. P. Duffels (ZMAN), and J. Margerison Knight (BMNH) to study specimens in their care and J. van Tol (RMNH) for the permission to study specimens in his care and help with the distribution maps. J.T. Polhemus (JTPC) for the loan of the unique holotype of *Rhagovelia grayi*, J. T. Polhemus and L. van den Hoek Ostende (RMNH) for criticism on the first draft of the manuscript.

#### SYSTEMATIC PART

##### Species groups in Indo-Pacific *Rhagovelia*

Polhemus & Polhemus (1988) divided the Indo-Pacific *Rhagovelia* species in eight species groups. A few species are reassigned below to other, partly newly erected, groups due to the increased knowledge of Indo-Pacific *Rhagovelia*. As a rule, however, the 'Polhemi'-groups seem to be monophyletic with the exception of the large *R. papuensis*-group. Our concept of the *papuensis*-group is mainly based on its Sulawesian and Philippine species which may constitute a restricted section of the group as compared to the interpretation of this group by Polhemus & Polhemus (1988). Apparently the largest number of species of this group is found in Sulawesi (Lansbury 1993, Nieser & Chen 1993, this paper). Nevertheless we decided against an evaluation of the entire group mainly for two reasons, this paper was meant to restrict its scope to Sulawesi and J.T. Polhemus (JTPC) informs us that he still has a number of undescribed species of this group from more eastern regions. It seems better to wait for a description of these additional species before attempting a final evaluation of the *papuensis*-group.

Five species were found to be sufficiently aberrant that they are considered to constitute two new species groups: the *gyrista*- and *plychona*-groups (with three and two species respectively) which, at least superficially seem to be related to each other. Since the study by Matsuda (1956) it is known that the knowledge of macropterous and dealate specimens is very important for the delimitation of species groups in the genus *Rhagovelia*, so these two new groups are mainly based on characteristics of the macropterous morph.

The occurrence of the *R. sarawakensis*-group in

Sulawesi is doubtful. There is only one record, a macropterous female of the Bornean species *R. samarinda* Polhemus & Polhemus (1988).

#### Keys to the species-groups of Sulawesi

##### Apterous specimens

1. Pronotum shorter than length of an eye, mesonotum exposed . . . . *R. sarawakensis*-group
- Pronotum much longer than length of an eye (fig. 21, mesonotum covered by pronotum, at most its hind margin visible . . . . . 2
2. Males . . . . . 3
- Females . . . . . 6
3. Hind femur with teeth or granules in proximal third (figs. 2, 4) . . . . . 4
- Hind femur without teeth or granules in proximal third (figs. 1, 13) . . . . . 5
4. Body dorsally and antennae with dense appressed golden pubescence, inner side of hind tibia regularly and sharply indented (fig. 11) . . . . . *R. gyrista*-group
- Body dorsally and antennae without conspicuous golden pubescence, inner side of hind tibia irregularly indented (figs. 2, 8) . . . . . *R. papuensis*-group
5. Anterior trochanter with a tuft of hairs, body dorsally with conspicuous golden pubescence, hind femur basally yellow . . *R. ptychona*-group
- Anterior trochanter without a tuft of hairs, body dorsally without conspicuous golden pubescence, hind femur basally black in most species . . . . . *R. orientalis*-group
6. Hind femur curved, its anterior face (partly) flattened and densely pubescent, hind femur without teeth or with some small teeth on the posterior face (fig. 12) . . . . . *R. gyrista*-group
- Hind femur without these combination of characters, in most species with teeth on the ventral margin, only rarely without teeth . . . . . 7
7. Dorsum covered with golden pubescence, hind femur without teeth ventrally (fig. 14) . . . . . *R. ptychona*-group
- Dorsal pubescence sometimes yellow but without golden metallic shine, hind femur usually with some teeth or spines . . . . . 8
8. Legs slender, with metallic shine, middle and hind femur basally black (except in *R. kastanoparuphe*), connexiva black (except in *R. kastanoparuphe*), abdomen short, its outlines convergent (fig. 21), tergite 7 frequently with a process (fig. 34), jugae and propisterna without black spicules . . . . . *R. orientalis*-group
- Legs stouter (figs. 3, 8, 9), without metallic . . .

shine, middle and hind femur basally yellow, connexiva yellow (except: brown in *R. pruinosa*), tergite 7 without process, abdomen longer, its outlines (not that of the connexiva) less convergent (figs. 17, 20), jugae and proepisterna with or without black spicules . . . *R. papuensis*-group

#### Macropterous specimens

Macropterous specimens of the *R. gyrista*-group are unknown.

1. Hairs on fore wing restricted to costal margin . . . . . 2
  - Hairs on fore wing covering a large area in the anterior part of its base . . . . . *R. ptychona*-group
2. Closed cells of fore wing reaching the apical third . . . . . 3
  - Closed cells of fore wing reaching only the apical half, abdominal carinae reaching tergite . . . . . *R. sarawakensis*-group
3. Fore wing brown or black, without a longitudinal yellowish streak basally, abdominal carinae reaching tergite 2 . . . . . *R. orientalis*-group
  - Fore wing brown or black, with a longitudinal white or yellowish streak basally, abdominal carinae reaching tergite 3 . . . *R. papuensis*-group  
(See also characteristics used for identification of apterous specimens of these two groups.)

#### Dealate specimens

Dealate specimens of the *R. ptychona*- and the *R. papuensis*-group are unknown.

1. Fore wing broken at middle, behind its cells . . . . . *R. sarawakensis*-group
  - Fore wing broken at base . . . . . 2
2. Hind femur in male with a row of small teeth in proximal third, in female curved, flattened and anteriorly pubescent . . . . . *R. gyrista*-group
  - Hind femur in male without teeth in proximal third, not curved flattened, or pubescent in female . . . . . *R. orientalis*-group

#### The *Rhagovelia papuensis*-group

Diagnosis: Variable in size, length 2.6 - 5.3 mm, generally slender. Colour variable, from black to yellowish, in most species at least connexiva yellowish or reddish. Legs extensively yellowish in most species. Pronotum of apterous specimens long, covering the mesonotum completely or nearly so. Fore wing with three or four closed cells reaching its apical third. Fore wing with a longitudinal white or yellowish streak basally. Dorsal abdominal carinae of winged specimens extending posteriorly to tergite 3. Dealate specimens unknown. Hind femur of males strongly thickened in most species.

Distribution: Sri Lanka, India, Taiwan, Philippines, Borneo, Sulawesi, Moluccas, New Guinea, Australia, Solomon Islands.

This is the largest species-group in Sulawesi and in the Philippines, whereas from the other parts of its distribution area only a few species have been recorded.

#### Key to the species of Sulawesi and adjacent islands (apterous specimens)

Male of *R. unica* unknown.

1. Females . . . . . 2
  - Males . . . . . 20
2. Connexiva strongly convergent, folded over abdomen and touching or nearly touching each other posteriorly part, consequently at least partly covering tergite 7 (figs. 18, 19) . . . . . 3
  - Connexiva, although strongly convergent in some species, distinctly separated in posterior part, tergite 7 largely uncovered (figs. 15-17, 20) . . . . . 9
3. Hind femur petiolate, outline from its base to the base of the first tooth concave (fig. 9), outer rim of connexiva, sometimes indistinctly, narrowly shining on segments 4 and 5 . . . . . 4
  - Hind femur not petiolate, outline from its base to the base of the first tooth convex or, rarely, straight (fig. 3) . . . . . 7
4. Connexiva of segment 6 with many long hairs, process of connexiva directed upward (figs. 18, 29) . . . . . *R. tsouloufi* sp.n.
  - Connexiva of segment 6 without long hairs, process of connexiva directed more or less horizontally posteriorly . . . . . 5
5. Mesopleurae anteriorly rugulose, but without pit punctures . . . . . *R. minahasa*
  - Mesopleurae anteriorly with distinct pit punctures . . . . . 6
6. Length 3.5 - 3.8 mm, sternite 7 laterally on hind margin with a tuft of long black hairs (fig. 27) . . . . . *R. krama* sp.n.
  - Length 2.8 - 3.0 mm, sternite 7 laterally on hind margin without long black hairs, but gonocoxa with longer hairs . . . . . *R. blogiokommene*
7. Connexiva on segments 2 and 3 with long, erect hairs and on segment 7 with a long and slender process, predominately black species . . . . . *R. trichota*
  - Connexiva of segments 2 and 3 without long hairs, process on segment 7 different, predominately yellowish to brown species . . . . . 8
8. Process of connexiva very long and flattened, middle and hind femora flattened . . . . . *R. lorelinduana*
  - Process of connexiva shorter, triangular, middle



- and hind femora not flattened ..... *R. grayi*
9. Tergite 8 horizontal, in the same plane as tergite 7 (figs. 25, 26) ..... 10
- Tergite 8 vertical or obliquely directed downward, not in the same plane as tergite 7 (figs. 28, 30) ..... 15
10. Connexiva of segment 4 with a distinct tuft of long hairs (fig. 16) ..... 11
- Connexiva of segment 4 without long hairs (fig. 20) ..... 12
11. Hind femur without teeth proximally of the long spine in the middle, connexiva of segment 7 internally and posterior corners of tergite 8 with distinct tufts of quite long hairs ... *R. tropidata*
- Hind femur with at least one spine-like smaller tooth proximal of the long spine in the middle (fig. 8), connexiva of segment 7 internally and tergite 8 with some hairs which are not grouped in tufts (fig. 16) ..... *R. achna* sp.n.
12. Connexiva dark, on segment 4 with a swollen shining area, and with longer hairs internally on segments 6 and 7, tergite 8 with many long hairs in caudal third ..... *R. pruinosa*
- Connexiva yellow, without swollen shining area on segment 4, with or without longer hairs on segment 6 and 7, tergite 8 at most with longer hairs in the posterior corners ..... 13
13. Body completely yellow, connexiva without longer hairs (except serial setae, fig. 25) ..... *R. ochra* sp.n.
- Body partly dark, connexiva with longer hairs on segments 4, 6 or 7 ..... 14
14. Connexiva on segment 4 strongly convergent, on segment 7 internally with long hairs, metanotum with a pair of tubercles laterally, tergites 4 - 5 with a distinct carina along middle ..... *R. robina*
- Connexiva more or less straight, gradually convergent from base to tip, on segment 7 internally without long hairs, metanotum without a pair of tubercles, tergites without carina ... *R. kalamii*
15. Connexiva densely set with many long erect hairs, especially on segments 6 and 7 ... *R. unica*
- Connexiva without erect hairs or at most with 1 - 5 bristle-like hairs on each segment ..... 16
16. Connexiva of segment 7 produced in an elongate spiniform process (figs. 27, 28, 30), hind femur slightly petiolate and with a few small denticles in basal third ..... 17
- Connexiva of segment 7 produced in a short triangular process, hind femur not petiolate and without small denticles in basal third ..... 19
17. Sternite 7 laterally on hind margin with a tuft of long black hairs (figs. 27, 30) ..... 18
- Sternite 7 laterally without long black hairs (fig. 28) ..... *R. abra* sp.n.
18. Sternites black, outer margin of connexiva dull brownish, little contrasting; tergites 1-3 with a few scattered bristles (fig. 17), connexiva with 1-4 bristles per segment (fig. 30) ... *R. skoura* sp.n.
- Sternites partly yellow, outer margin of connexiva of a well contrasting medium brown to dull orange; tergites 1-3 without bristles (fig. 19), connexiva on each side with two bristles on segment 1 only ..... *R. krama* sp.n.
19. Hind femur strongly incrassate, less than 3.5 times as long as wide, laterotergites 3 and 4 with longer hairs than laterotergite 5 ... *R. wallacei*
- Hind femur more slender, more than 4.0 times as long as wide (without teeth), laterotergites 3 - 5 with equally short hairs ..... *R. horaia*
- ### Males
20. Hind femur with a long spine in the middle of its length, followed by a row of spines of gradually decreasing length distally, proximally of the long spine with a single row of short black granules of which the last may be slightly longer and tooth-like (figs. 2, 4-6, 10); hind tibia variable ..... 21
- Hind femur ventrally with two larger spines of subequal length, one in proximal third and one distally of the middle, each followed by a row of spines of decreasing length (fig. 7), proximal third with a row of short black granules; hind tibia sinuate and with a larger tooth in distal third ..... *R. achna* sp.n.
21. Sternite 7 with a distinct tuft of hairs medially ..... 22
- Sternite 7 without a tuft of hairs, but sometimes with longer hairs on a median carina ..... 23
22. Tuft of hairs near to the anterior margin of sternite 7, hairs on tergites short ..... *R. pruinosa*
- Tuft of hairs about halfway on sternite 7, hairs on tergites longer, slightly shorter than length of tergite 4 ..... *R. kalamii*
23. Tergites with numerous erect black hairs which are distinctly longer than length of tergite 4, connexiva reddish to dark brown, body length usually over 2.9 mm ..... 24
- Tergites without hairs or with shorter, more oblique hairs which are much shorter than length of tergite 4, only in one small species (body length up to 2.92 mm) with yellow connexiva the hairs more erect and only slightly shorter than tergite 4 ..... 26
24. Hind femur relatively slender, more than 3.5 times longer than wide, proximal row with more than ten granules, tip of paramere slender ..... *R. trichota*
- Hind femur stouter, less than 3.0 times longer than wide, basal row with less than ten granules,

- tip of paramere wide ..... 25
25. Proepisterna with small black denticles in anterior part, sides of pronotum black *R. skoura* sp.n.  
– Proepisterna without small black denticles, sides of pronotum yellow ..... *R. tsouloufi* sp.n.
26. Hind tibia distinctly curved, with a larger tooth in the distal third, colour of pronotum completely yellow, orange brown, or brown, parameres apically with a ventral broadening (fig. 40) ..... 27  
– Hind tibia straight or only very slightly curved, without larger tooth, colour of pronotum partly black, at least in the middle of posterior half, apex of paramere not ventrally widened (figs. 35, 37) ..... 30
27. Proximal row on hind femur with more than 25 black granules ..... *R. grayi*  
– Proximal row on hind femur with less than 23 black granules ..... 28
28. Lateral parts of tergites with scattered small black denticles, extending at least in low numbers to laterotergites ..... 29  
– Tergites and laterotergites without small black denticles ..... *R. lorelinduana*
29. Laterotergites with numerous black denticles, connexiva of segments 2 - 6 without any longer hairs ..... *R. ochra* sp.n.  
– Laterotergites with very few scattered black denticles, connexiva with at least one longer hair in the posterior corner of each segment *R. horaia*
30. Sternites 5 and 6 medially with tufts of long dark hairs, black denticles scarce on the lateral parts of the thorax and lacking or very scarce on lateral parts of sternites, on laterotergites and tergites ..... *R. wallacei*  
– Sternites 5 and 6 medially only with slightly longer, yellow hairs, if with a small tuft on sternite 5, then black denticles numerous in these parts ..... 31
31. Black denticles restricted to proepisterna, small species (body length up to 2.92 mm) with rather long suberect hairs on tergites *R. blogiokommene*  
– Black denticles extending to mesopleura, metapleura, sternites, laterotergites and the lateral parts of tergites, hairs on the tergites shorter ..... 32
32. Abdomen and metathorax completely yellowish to orange brown, tergites only with short appressed hairs, hind femur slender, about 3.5 times as long as wide, paramere with broadened apex and sternite 7 with a blunt carina ..... *R. robina*  
– Abdomen extensively black, tergites with scattered longer, suberect hairs, hind femur stouter, at most 3.0 times as long as wide, parameres with simple tip or sternite 7 with a strongly developed narrow keel ..... 33
33. Sternite 7 laterally compressed, with a strongly developed median carina, which is accentuated by a well developed fringe of hairs, paramere with broadened apex ..... *R. tropidata*  
– Sternite ventrally flattened, with a low median carina, paramere with simple tip ..... 34
34. Black denticles all over the anterior margin of the pronotum, numerous in the median yellowish area, median carina of sternite 7 very faintly indicated ..... *R. abra* sp. n.  
– Black denticles lacking in the middle part of the anterior margin of the pronotum, median carina in posterior part of sternite 7 low, but distinct, and accentuated by shallow lateral impressions ..... 35
35. Pro-, meso- and metapleura densely set with black denticles, hind margin of pronotum black ..... *R. minahasa*  
– Pro-, meso- and metapleura set with at most a few black denticles, hind margin of pronotum yellow ..... *R. krama* sp.n.

### *Rhagovelia blogiokommene* Nieser & Chen

*Rhagovelia blogiokommene* Nieser & Chen 1993: 268, figs. 2-6, 82.

Material. – Sulawesi Selatan, Batusitanduk {2°48'S 120°10'E} N of Palopo, narrow river, 2.XI.1993, leg. J. P. & M. J. Duffels 1♂ 10♀ apterous, 2♂ 3♀ macropterous (ZMAN, 1♂ 1♀ macr. NCTN); Onang {3°07'S 118°49'E}, Sungai Parabaya, 19.XI.1993, leg. J. P. & M. J. Duffels, 4♂ 7♀ apt. (ZMAN, 1♂ 1♀ NCTN, 1♂ 1♀ NHMW).

Previously known from three localities in the S half of Sulawesi all under 100 m asl.

### *Rhagovelia kalami* Nieser & Chen

*Rhagovelia kalami* Nieser & Chen 1993: 273-274, figs. 24-29, 82.

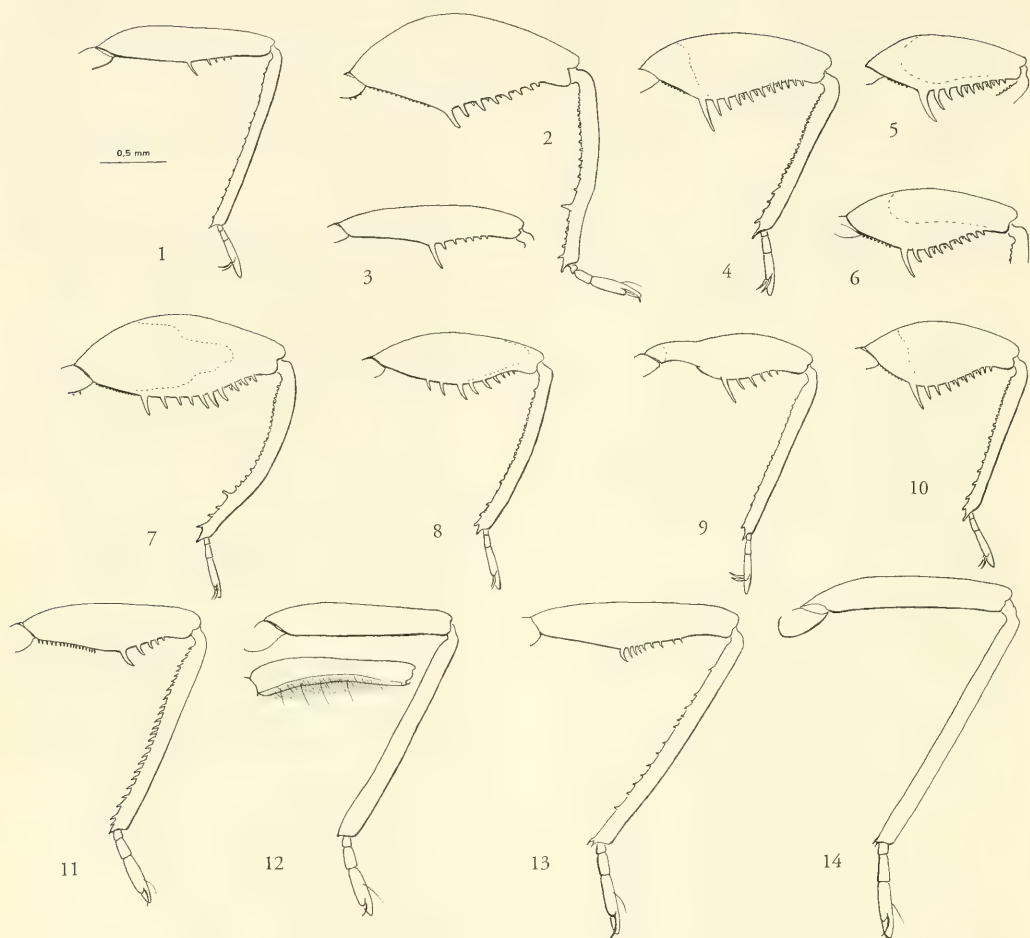
Material. – Sulawesi Selatan, Zuid Celebes, Nanggala, 800m, Rantepao, VIII. 1937, leg. F. C. Drescher, 1♂ apt. (BMNH)

This specimen has a much darker colour than the type series from Buton Island, however, structurally we have found no differences. Previously known by the type series from Buton only.

### *Rhagovelia pruinosa* Polhemus & Polhemus

*Rhagovelia pruinosa* Polhemus & Polhemus 1988: 195-195, figs. 149-157, 229.

Material. – Sulawesi Selatan, SW Celebes, 1100m, Mt. Lompobatang area, Malino {ca 5°15'S



Figs. 1-14. Hind legs or hind femur of apterous specimens of *Rhagovelia*: 1 *R. cylindros* ♂, 2 *R. ochra* ♂, 3 *R. ochra* ♀, 4 *R. skoura* ♂, 5 *R. abra* ♂, 6 *R. krama* ♂, 7 *R. achna* ♂, 8 *R. achna* ♀, 9 *R. tsouloufi* ♂, 10 *R. tsouloufi* ♀, 11 *R. gyrista* ♂, 12 *R. gyrista* ♀ (inset: femur in frontal view), 13 *R. plychona* ♂, 14 *R. plychona* ♀.

119°48'E}, 2, 8-10.VI.1982, M. A. Lieftinck, 1 ♂ (RMNH); Sulawesi Selatan, C. Sulawesi, Batusitanduk, NW of Palopo {ca 120°09'E 2°50'S}, narrow river 2.XI.1993, leg. J. P. & M. J. Duffels, 1 ♂ (ZMAN).

Widely distributed in South and East Sulawesi and Buton (Nieser & Chen 1993)

*Rhagovelia abra* sp. n.  
(figs. 5, 15, 28, 35, 45)

Type material. – Holotype apterous ♂ (ZMAN): IN-

DONESIA: Sulawesi Selatan, E side lake Matana, Sg. Salura, 450m, 20 Oct 1993, narrow tributary to lake Matana, 2°32'S, 121°28'E, J. P. & M. J. Duffels (fig. 45). – Paratypes, same data as holotype 3 ♂ 5 ♀ all apterous (1 ♂ 3 ♀ including allotype ZMAN, 1 ♂ 1 ♀ NCTN, 1 ♂ 1 ♀ NHMW).

Description. – Apterous form. Dimensions. Length ♂ 2.98-3.05, ♀ 3.10-3.23; width ♂ 1.05-1.12, ♀ 1.18-1.21; width of head ♂ 0.72-0.74, ♀ 0.75-0.79; width of pronotum ♂ 0.90-0.98, ♀ 0.98-1.03.

Colour generally dark grey-brown to blackish, an-



Table 1

Measurements of leg segments in *Rhagovelia*. Tarsal segments 1 and 2 of fore and hind legs have not been measured for most species. When not given, they measure together 0.05-0.07 and 0.12-0.15 respectively and do not seem to provide specific characters.

(continued)											
	femur	tibia	tars1	tars2	tars3		femur	tibia	tars1	tars2	tars3
<i>R. abra</i> ♂						<i>R. ochra</i> ♀					
fore leg	0.85	0.90	-	-	0.22	fore leg	0.96	0.96	-	-	0.21
middle leg	1.40	1.14	0.06	0.42	0.67	middle leg	1.57	1.27	0.07	0.44	0.71
hind leg	1.25	1.12	-	-	0.25	hind leg	1.39	1.49	-	0.10	0.40
<i>R. abra</i> ♀						<i>R. ptychona</i> ♂					
fore leg	0.85	0.88	-	-	0.25	fore leg	1.21	1.35	-	-	0.31
middle leg	1.42	1.09	0.07	0.41	0.68	middle leg	2.01	1.64	0.09	0.77	0.86
hind leg	1.19	1.17	-	-	0.26	hind leg	1.53	1.79	0.07	0.18	0.40
<i>R.achna</i> ♂						<i>R. ptychona</i> ♀					
fore leg	0.90	0.98	-	-	0.27	fore leg	1.28	1.37	-	-	0.33
middle leg	1.54	1.21	0.08	0.41	0.67	middle leg	1.95	1.67	0.07	0.79	0.88
hind leg	1.56	1.42	0.07	0.10	0.33	hind leg	1.50	1.86	0.08	0.18	0.42
<i>R. achna</i> ♀ *						<i>R. skoura</i> ♂					
fore leg	0.83	0.91	-	-	0.25	fore leg	0.90	1.00	-	-	0.27
middle leg	1.43	1.06	0.07	0.37	0.65	middle leg	1.51	1.17	0.08	0.40	0.70
hind leg	1.28	1.22	0.06	0.08	0.30	hind leg	1.34	1.23	-	0.10	0.33
<i>R. cylindros</i> ♂						<i>R. skoura</i> ♀					
fore leg	0.93	1.01	-	-	0.23	fore leg	0.91	0.96	-	-	0.26
middle leg	1.59	1.18	0.09	0.57	0.71	middle leg	1.46	1.10	0.08	0.43	0.72
hind leg	1.34	1.31	0.06	0.09	0.26	hind leg	1.32	1.30	0.07	0.10	0.31
<i>R.cylindros</i> ♀						<i>R. sterea</i> ♀ *					
fore leg	0.92	0.97	-	-	0.22	fore leg	1.10	1.12	-	-	0.30
middle leg	1.52	1.12	0.07	0.51	0.73	middle leg	1.72	1.47	0.08	0.60	0.78
hind leg	1.23	1.36	0.07	0.10	0.27	hind leg	1.30	1.65	0.07	0.12	0.40
<i>R. krama</i> ♂						<i>R. tsouloufi</i> ♂					
fore leg	0.93	0.98	-	-	0.24	fore leg	0.82	0.88	-	-	0.23
middle leg	1.57	1.20	0.08	0.50	0.68	middle leg	1.35	1.12	0.07	0.40	0.66
hind leg	1.34	1.24	0.07	0.10	0.30	hind leg	1.26	1.20	0.06	0.09	0.28
<i>R. krama</i> ♀						<i>R. tsouloufi</i> ♀					
fore leg	0.95	1.00	-	-	0.23	fore leg	0.84	0.90	-	-	0.23
middle leg	1.54	1.23	0.08	0.50	0.71	middle leg	1.36	1.11	0.08	0.41	0.68
hind leg	1.36	1.36	0.06	0.09	0.28	hind leg	1.16	1.22	0.07	0.10	0.24
<i>R. ochra</i> ♂						* based on a single specimen					
fore leg	1.08	1.11	-	-	0.24						
middle leg	1.64	1.42	0.08	0.50	0.72						
hind leg	1.71	1.55	-	0.12	0.38						

terior quarter of pronotum orange-yellow, connected with yellowish to light brown propleura and prosternum. Dorsal half (males) to two thirds (females) of connexivum brownish, not very contrasting. Venter castaneous, medial area darker, juga, prosternum, abdominal sternite 7 and genital segments of male lighter. Basal half of first antennal segment, basal part of rostrum, basal three quarters of fore femur, basal third of hind femur, acetabula, coxae and trochanters

pale; hind femur in ventral view medium brown. Paler parts of fore femur variable between specimens, ventrally more extensive than dorsally.

Minute black denticles spread over propleura and the orange band on pronotum, on mesosternum reaching to mesoacetabula but not much on mesopleura. Mesopleuron in front of acetabulum with a group of 6-8 coarse punctures more distinct in females than in males. Dorsum, especially pronotum

rather bare, punctures on posterior three quarters of pronotum distinct. Vertex interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae.

Length of antennal segments ( $\delta$  and  $\eta$ ) I : II : III : IV 0.72 : 0.37 : 0.50 : 0.43. Pronotum long, covering mesonotum, length : width 0.78 : 0.96. Length of metanotum on midline, 0.10. Abdominal tergites 1-5 subequal in length (0.15-2.0), tergite 6 slightly longer (0.30) in female, tergite 7 0.30 in male, 0.38 in female.

Male. Posterior trochanter with 2-3 small but distinct blunt teeth. Posterior femur three times as long as wide (1.25/0.4), ventral margin in proximal third with about eight minute and closely set teeth followed by a row of about eight larger spines decreasing in size, of which the first (proximal) is half as long as the width of femur (fig. 5). A row of five smaller spines located in distal part ventrally of the main row. Larger spines black tipped, smaller spines and teeth entirely black or nearly so. Posterior tibia virtually straight, armed beneath with a row of about 15 rather coarse pegs. Connexiva more or less horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 and 8 subequal to their median lengths. Abdominal sternites 2-6 of subequal length (0.15-0.20), sternite 7 longer (0.3) with a pair of shallow impressions separated by a narrow and low keel, sternite 8 with an indistinct ventral keel. Parameres as in fig. 35.

Female. Posterior trochanter without small teeth. Posterior femur nearly three and a half times as long as wide (1.2/0.35), proximal row of minute teeth replaced by 4-5 coarser teeth, larger spines except for the first shorter than in male. Posterior tibia with somewhat smaller and less distinct pegs as in male. Connexiva more or less vertical, on tergites 4 and 5 somewhat sinuate, otherwise gradually converging caudally, caudally leaving most of tergites uncovered (fig. 15, apices pointed, accentuated by a tuft of caudally directed bristles. Tergite 8 slanting ventrad at an angle of about  $0.25\pi$ . Proctiger vertical. Sternite 7 about half as long as remaining abdominal sternites (0.5/1.0). Gonocoxa hidden in segment 7 (fig. 28).

Etymology. – Abros, greek adjective meaning coarse, referring to the extensive cover of fine denticles.

Comparative notes. – Similar to *R. blogiokommena*, *R. tropidata*, *R. wallacei* and, in males, *R. minahasa*. Of these *R. blogiokommena* has the black denticles restricted to the posterior part of jugum and the anteroventral part of propleura alongside the rostrum. The others have the minute black denticles distinctly present on pro- and meso-pleura. *R. minahasa* lacks mesothoracic punctures and has the connexiva of the

female folded over the abdomen on segments 5-7. *R. tropidata* has a prominent ventral keel on sternite 7 in males, *R. wallacei* has characteristic tufts of bristles abdominal sternites 5 and 6 and the connexiva slanting upward in males. The latter two species have the minute black denticles not extending onto the orange transverse band dorsally on pronotum as in *R. abra*. Females of *R. tropidata* and *R. wallacei* have the apices of connexiva more truncate than *R. abra*, only 0-2 small teeth on proximal ventral margin of hind femur and, moreover, in *R. wallacei* females the connexiva are straight.

*Rhagovelia achna* sp. n.  
(figs. 7, 8, 16, 26, 36, 45)

Type material. – Holotype apterous  $\delta$  (NHMW) INDONESIA: Sulawesi, Togian Inseln, 3 Feb 1995 leg. Seifert & Greindl (59) (fig. 45). – Paratypes same data as holotype 3  $\delta$  2  $\eta$  (NHMW, 1  $\delta$  NCTN).

Description. – Apterous form. Medium sized relatively slender and pale species. Dimensions. Length  $\delta$  3.10-3.15,  $\eta$  3.26; width  $\delta$  1.15-1.18,  $\eta$  1.18; width of head  $\delta$  0.76-0.78,  $\eta$  0.75; width of pronotum  $\delta$  1.01-1.07,  $\eta$  1.02.

Colour generally brownish. Anterior quarter of pronotum orange-yellow, connected with equally pale propleura and prosternum, meso- and meta-pleura orange-brown. Disk of pronotum medium to light brown, with an ill-defined lighter median longitudinal stripe. Abdomen dorsally and laterally medium brown, outer half of connexiva orange-yellow. Venter orange-brown. Antenna grey-brown basal half to three quarters of first segment pale. Acetabula, coxae, trochanters and most of anterior and posterior femur sordid pale yellowish. Middle femur except for base, tibiae and tarsi grey-brown. Apex of anterior femur and variable dorsal and ventral stripe on hind femur greyish.

Minute black denticles prominent on thoracic and abdominal venter to sternite 6, spreading on propleura and bases of jugae. A line of pits anteriorly and posteriorly on orange-yellow band of pronotum, pitting of posterior three quarters of pronotum and mesopleuron (fig. 26) distinct. Body clothed with short pubescence with some sparse fine longer hairs, thicker and more prominent laterally and ventrally (especially caudally in males), disc of pronotum rather bare. Most of abdominal tergite 7 (and genital tergites of male) free of pubescence, shining. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae.

Length of antennal segments ( $\delta$  and  $\eta$ ) I : II : III : IV 0.75 : 0.40 : 0.56 : 0.43. Pronotum long, covering mesonotum, shorter than wide (0.8/1.0). Length

of metanotum on midline, 0.1. Abdominal tergites 1-5 subequal in length (0.2), tergite 6 subequal in male slightly longer (0.25) in female, tergite 7 0.35 in ♂, 0.40 in ♀. Abdominal sternites 2-6 subequal (0.2) and 7 longer (0.30) in male. In female sternites 2-5 subequal (0.2), 6 slightly (0.25) and 7 distinctly (0.45) longer.

Male. Posterior trochanter with about four small but distinct blunt teeth. Posterior femur strongly incrassate, on average two and a half times as long as wide (1.55/0.62). Ventral margin in proximal quarter with about twelve very small closely set teeth followed by an irregular row of about ten larger spines of which the larger ones are about as long as one fifth the width of femur (fig. 7) dorsally and a row of about four smaller spines (of the same size as the apical ones in the dorsal row) ventrally in distal third. Posterior tibia distinctly curved, armed beneath with a double row of about 30 small teeth in proximal three quarters, followed by 4-6 larger teeth of which the first, marking distal quarter is the most prominent. Spines and teeth brown tipped, the smaller ones nearly entirely brown. Connexiva slanting upward about 0.25π gradually converging posteriad leaving tergite 7 exposed. Basal width of abdominal tergite 7 less than its median length (0.30/0.35). Venter with a low broad keel, abdominal sternite 7 flattened with median keel more prominent. Sternite 8 shorter than sternite 9 (0.25/0.30), sternite 8 with an indication of a median keel basally. Parameres rather long (fig. 36).

Female. Posterior trochanter without small teeth. Posterior femur about 3.5 times as long as wide (1.28/0.37), with an irregular row of spines about seven in apical two thirds only, consisting of one larger spine (about half as long as the width of femur) preceded by one and followed by five smaller, distally decreasing, teeth dorsally and a row of about four smaller spines (of the same size as the apical ones in the dorsal row) ventrally in distal third (fig. 8). Posterior tibia with a double row of about 30 small but distinct teeth in proximal three fourth. Connexiva more or less vertical, curved inward and with a somewhat thickened rim accentuated by somewhat stronger developed pilosity on paratergite 4, caudal part virtually parallel, converging slightly on last segment only, leaving the tergites uncovered (fig. 16), apices truncate with a few bristles only. Tergite 8 and proctiger horizontal. Gonocoxa distinctly protruding (fig. 26).

Macropterous form unknown.

Etymology. – *Achnos*, greek adjective meaning sal-low, referring to the somewhat indefinite general colour.

Comparative notes (see key). – Separated from all other Sulawesi species in this group by the armature

of the hind femur in both sexes. This characteristic and the shape of the parameres set this species closer to some Philippine species (*R. cotabatoensis* Hungerford & Matsuda and related species).

*Rhagovelia krama* sp. n.  
(figs. 6, 19, 27, 37, 45)

Type material. – Holotype apterous ♂ (RMNH) INDONESIA: Sulawesi Selatan: C. Sulawesi, 30 km N Wotu, Sg. Anoa, river through primary forest above waterfall near bridge Wotu-Tentena, upstream ponded sites, small tributaries, boulder-sand, w=4-8m, d=0.2-0.8m, 650m (asl), 20°20'30"S, 120°47'45"E, 26 Oct. 1993, leg. J. van Tol (fig. 45). – Paratypes, same data as holotype 3♂ 2♀ apterous, distributed as follows, 1♂ 1♀ (allotype) RMNH, 1♂ 1♀ NCTN, 1♂ NHMW; C. Sulawesi, Sg. Anowah, 41 km N of Wotu along Trans-Sulawesi Highway, narrow streams in undisturbed rainforest above waterfall, 650m asl. 24.X.1993, J. P. & M. J. Duffels 1♂ 1♀ apterous (ZMAN)

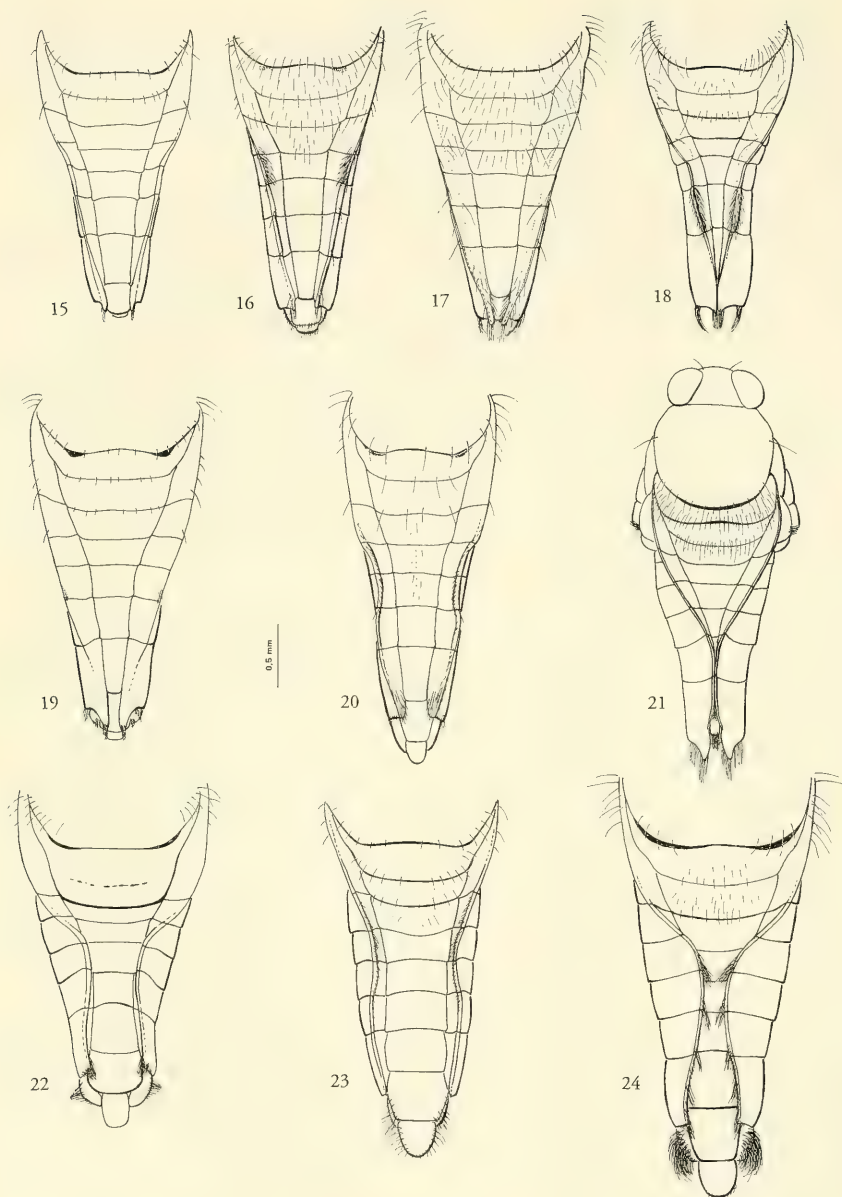
Description. – Apterous form. Medium sized generally dark species. Dimensions. Length ♂ 3.20-3.38, ♀ 3.50-3.78; width ♂ 1.12-1.25, ♀ 1.30-1.38; width of head ♂ 0.77-0.80, ♀ 0.82-0.83; width of pronotum ♂ 0.97-1.04, ♀ 1.11-1.12.

Colour generally dark grey, anterior quarter of pronotum yellow connected with yellow propleurae and prosternum. Basal three quarters of antennal segment 1, acetabula, coxae, trochanters, basal four fifth of anterior femur, ventral surface of middle and hind femur, basal quarter of hind femur dorsally, ventral surface of hind tibia, abdominal sternite 7 and genital sternites yellow to light brown. Connexiva with an orange-brown rim about half as wide as connexiva in male, three quarters as wide in female.

Minute black denticles distinct laterally and latero-ventrally on thorax and basal half of abdomen, extending to jugae, propleurae, along lateral part of anterior margin of pronotum, acetabulae, connexiva and the basal abdominal tergites. Posterior three quarters of pronotum punctured, in addition a few punctures laterally near anterior margin of pronotum and at posterior margin of propleurae. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body clothed with sordid yellowish pubescence, dorsally more distinct in males than in females. Caudal segments of abdomen with some more distinct pilosity.

Length of antennal segments I : II : III : IV ♂ 0.76 : 0.40 : 0.51 : 0.45, ♀ 0.80 : 0.41 : 0.50 : 0.45. Pronotum long, covering mesonotum, shorter than wide (♂ 0.8/1.0, ♀ 0.9/1.1). Length of metanotum on middle line, 0.10-0.12. Abdominal tergites 1-4





Figs. 15-24. Dorsal view of abdomen of apterous females of *Rhagovelia*: 15 *R. abra*, 16 *R. achna*, 17 *R. skoura*, 18 *R. tsouloufi*, 19 *R. krama*, 20 *R. ochra*, 21 *R. cylindros* (body without extremities), 22 *R. gyrsta*, 23 *R. sterea*, 24 *R. plichona*.

subequal in length (0.2), tergite 5 subequal, 6 slightly (0.23) and 7 distinctly (0.4) longer in male. Tergite 5 slightly (0.25), 6 clearly (0.33) and tergite 7 distinctly (0.6) longer in female. Abdominal sternites 3-5

subequal, 0.2 in both sexes; sternite 2 equal (0.2), 6 (0.25) and 7 (0.35) slightly longer in male. Sternites 2 (0.25) and 6 (0.33) slightly, sternite 7 distinctly (0.65) longer in female.

Male. Posterior trochanter with 2–4 small but distinct blunt teeth. Posterior femur incrassate, on average three times as long as wide (1.37/0.46). Ventral margin in proximal half with a somewhat irregular row of 10–15 very small closely set teeth followed by a double row of about ten larger spines decreasing in size distally, of which the first (proximal) is two fifth as long as the width of femur (fig. 6) dorsally and a row of 1–6 small spines (of the same size as the apical ones in the dorsal row) ventrally. Posterior tibia softly curved to virtually straight, armed beneath with an irregular double row of about 20 small teeth, distal teeth very slightly larger and sharper than proximals. Larger spines brown tipped, smaller ones nearly entirely brown. Connexiva more or less horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 three quarters its median length (0.3/0.4). Tergite 8 basally as wide as long (0.35). Abdominal venter with a, rather indistinct, median keel on sternites 4–7, accentuated in sternites 4 and 5 by pilosity, on 7 by flattening of the sternite. Sternite 8 laterally compressed basally, suggesting a continuation of the ventral keel. Parameres rather long (fig. 37).

Female. Posterior trochanter without small teeth. Posterior femur 'petiolate' proximally, nearly four times as long as wide (1.35/0.35), a few small teeth in proximal part only, row of spines in apical half consisting of one large spine (over half as long as the width of femur) followed by about 8 much smaller, distally decreasing, teeth. Posterior tibia with about 20 small but distinct teeth. Connexiva more or less horizontal on segments 1 and 2, on segment 3 and 4 torsion to vertical, on tergites 5 and 6 curved back outward and converging caudally, the prolonged apices nearly meeting over tergite 8 which is horizontal (fig. 19). Gonocoxa distinctly protruding, with a very shallow lateral impression (fig. 27).

Etymology. – Krama, Greek noun meaning mixture referring to this species combining various characteristics of related species.

Comparative notes. – This species belongs to a subgroup within the *papuensis* group consisting of relatively squat species with orangeish anterior band of pronotum connected with similarly coloured propleura, in males rather strongly inflated hind femur and virtually straight tibia without larger subapical tooth. In Sulawesi this set is represented by *R. blo-giokommene*, *R. tropidata* and *R. wallacei*, the females of these three have tergite 8 more exposed, males can be separated by the characteristics mentioned in the key.

### *Rhagovelia ochra* sp. n.

(figs. 2, 3, 20, 25, 40, 45)

Type material. – Holotype apterous ♂ (RMNH) INDONESIA: C. Sulawesi, 30 km N Wotu, Sg. Anoa, river through primary forest above waterfall near bridge Wotu-Tentena, upstream ponded sites, small tributaries, boulder-sand, w=4–8m, d=0.2–0.8m, 650m (asl), 20°20'30"S, 120°47'45"E, 26 Oct 1993, leg. J. van Tol (fig. 45). – Paratypes, same data as holotype 6♂ 2♀ apterous, 2♂ macropterous distributed as follows: 4♂ 2♀ (1 apt. allotype, 1 macr.) RMNH, 1♀ 1♂ apt., 1♂ macr. NCTN, 1♂ NHMW.

Description. – Apterous form. Medium sized slender and pale species. Dimensions. Length ♂ 3.55–3.58, ♀ 3.52–3.55; width ♂ 1.08–1.15, ♀ 1.16–1.19; width of head ♂ 0.74–0.80, ♀ 0.76–0.79; width of pronotum ♂ 0.98–1.00, ♀ 1.03–1.04.

Colour generally pale, yellow and light orange. Dorsal side mainly orange, eyes dark grey to brown, interoculus somewhat darker than rest of dorsal side, apex of rostrum brown. Anterior quarter of pronotum pale yellow, connected with equally pale propleura and prosternum. Lateral third to half of connexivum yellow. Venter mostly orange. First antennal segment yellowish, segments 2–4 brownish. Legs mostly yellowish, tarsi and apices of femurs and tibiae infuscated in most specimens.

Minute black denticles spread over body surface except anterior and dorsal parts of head and the pitted posterior three quarters of pronotum. Punctures on posterior three quarters of pronotum distinct. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body at first sight looking rather bare as its pubescence is short, appressed and in the same colour as body. Caudal segments of abdomen with some more distinct pilosity.

Length of antennal segments I : II : III : IV ♂ 0.81 : 0.49 : 0.69 : 0.54, ♀ 0.80 : 0.45 : 0.68 : 0.52. Pronotum long, covering mesonotum, shorter than wide (0.8/1.0). Length of metanotum on middle line, 0.12. Abdominal tergites 1–5 subequal in length (0.2), tergite 6 slightly longer 0.25 in male 0.30 in female, tergite 7 0.40 in both sexes. Abdominal sternites 3–5 subequal 0.15–0.20 in male, 0.20 in female; sternites 2 and 6 slightly (0.22) sternite 7 distinctly (0.40) longer in male. In female abdominal sternites 2 and 6 0.30 and sternite 7 0.50.

Male. Posterior trochanter with 4–6 small but distinct blunt teeth. Posterior femur variably incrassate, on average two and a half times as long as wide (1.68/0.69). Ventral margin in proximal half with about 20 very small closely set teeth followed by a double row of about 10 larger spines decreasing in

size distally, of which the first (proximal) is one third as long as the width of femur (fig. 2) dorsally and a row of 4-7 small spines (of the same size as the apical ones in the dorsal row) ventrally. Posterior tibia softly distinctly curved, armed beneath with a double row of about 40 (25 in inner, 15 in outer row) small teeth, most specimens with a somewhat larger tooth at apical third. Both curvature and development of larger tooth on tibia correlated with thickness of femur. Spines and teeth brown tipped, those on tibia nearly entirely brown. Connexiva more or less horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 less than its median length (0.35/0.40). Abdominal sternite 7 flattened medially, flat area diverging posteriorly in most specimens, with an indication of a broad, low median keel, lateral margins of flattened area accentuated in posterior half by tufts of bristles. Parameres rather long (fig. 40).

Female. Posterior trochanter without small teeth. Posterior femur slightly over five times as long as wide (1.39/0.27), with a single row of spines in apical half only, consisting of one large spine (about  $\frac{3}{4}$  as long as the width of femur) followed by 4-6 much smaller, distally decreasing, teeth (fig. 3). Posterior tibia with a single row of about 12 small but distinct teeth. Connexiva more or less vertical, on tergites 4 and 5 curved inward and with a somewhat thickened rim, otherwise gradually converging caudally, leaving most of tergites uncovered (fig. 20), apices only slightly pointed (fig. 25), more or less triangular. Tergite 8 and proctiger about horizontal in allotype, slanting ventrad at an angle of over  $0.25\pi$  in the other female. Gonocoxa distinctly protruding, with a shallow lateral impression in apical half.

Macropterous specimens (2♂ only). – Essentially as apterous form except for the development of thorax, wings and some details mentioned below. Length 3.70-3.75, humeral width of pronotum 1.40-1.41, median length of pronotum subequal to humeral width 1.33-1.40. General colour slightly darker than in apterous specimens, hemielytra dark, smoky brown-grey, proximal two thirds of lateral (anterior) proximal cell sordid white. Hemielytra reaching halfway to just over proctiger, with four cells two proximal elongate, reaching nearly halfway hemielytron. Outer (anterior) apical cell narrow reaching distal three quarters of hemielytron, central cell broad reaching distal two thirds. Hind wings dark smoky grey. Carinae on basal part of abdomen reaching to caudal margin of tergite 3. Connexiva horizontal, virtually parallel in the basal two thirds, curved medially in caudal two thirds.

Etymology. – Ochros, greek adjective meaning pale, referring to the general colour.

Comparative notes. – Its pale orange colour sets this species apart from anything seen in Sulawesi and the Philippines. Other comparatively light reddish species such as *R. robina* Nieser & Chen or *R. horaia* Nieser & Chen are, nevertheless, much darker and have the third antennal segment relatively shorter. *R. ochra* belongs to a subgroup of the *R. papuensis*-group characterized by a strongly inflated hind femur and a curved hind tibia with one or more larger subapical teeth in males and a relatively long third antennal segment (Nieser & Chen 1993). However, the third antennal segment in *R. ochra* is much longer than in the above mentioned species.

*Rhagovelia skoura* sp. n.  
(figs. 4, 17, 30, 38, 44)

Type material. – Holotype apterous ♂ (RMNH): INDONESIA: Sulawesi Utara, P. Sangihe, Bowokulu, 19.XI.1994, leg. N. Nieser, N9477 (fig. 44). Upper reaches of mountain stream, not much water, boulders, narrow stretches with strong current alternating with quiet pools. *Rhagovelia* on quiet stretch up and down stream of bridge. – Paratypes (NCTN unless otherwise stated): Same data as holotype 180♂ 106♀ apt., 2♂ macropterous, distributed as follows: 2♂ 3♀ (including allotype) RMNH; JTPC, NHMW, ZMAN each 2♂ 2♀ apt.; MBBJ, MUDH, SEMC each 1♂ 1♀ apt. – Additional paratypes (adults only), all Pulau Sangihe and leg. N. Nieser: Naha, Sungai Laine, 27.VI.1994, N9454. Lower reaches of stream, about 10m wide, mostly about 0.5 m deep, water slightly turbid (after a night of rain), bottom, coarse sand and pebbles. *Rhagovelia* at the edges between vegetation, 12♂ 10♀ apt. (2♂ 2♀ uscp); Naha, Sungai Laine, at last bridge upstream, 27.VI.1994, N9456. Slowly flowing river partly filled with *Hydrilla*, water faintly bluish (probably soap from washing cloth), 3♂ 3♀ apt.; Akembawu, ford & bridge in Sungai Dali, 16.XI.1994, N9470. Open terrain with some xerophytic plants, stones & boulders (the ford is an outlet in case of banjir). Sample from mouth at sea to 1.5 km inland, 27♂ 37♀ apt., 2♂ 1♀ macr., 1 lvV; Desa Simuang (near Malahu), Sungai Simuang, 28.VI.1994 (for details see *R. cylindros*), 24♂ 27♀ apt., 1♀ macr.; Desa Laine, Sungai Laine, pothole at water fall, 12.XI.1994, N9463 (for details of habitat see under *R. cylindros*). *Rhagovelia* at open to moderately open spots, 48♂ 56♀ apt., 34♂ 30♀ macr., 5 lvv. (JTPC, MBBJ, NHMW, OXUM, SEMC, ZMAN each 1♂ 1♀ macr.); Lelepu, Sura (=Sungai) Lelepu, 13.XI.1994, leg. N. Nieser, N9464. Mainly lowland stream aspect, some *Rhagovelia* also from stretch with mountain stream aspect, 59♂ 53♀ apt., 7♂ 8♀ macr., 40 lvv; Desa Utaurano, Sungai Apanukang, 14.XI.1994, N9465, (for details see *R. cylindros*)



19♂ 42♀ apt., 12♂ 14♀ macr.; same, pothole, N9465A 8♂ 7♀ apt., 2♂ 1♀ macr.; Sungai Masalihe, 16.XI.1994, N9468, mountain stream in rather deep (c. 20m) gorge. Main stream rather rough, mainly boulders and rapids, some quieter bays with pebbles and sand. Most *Rhagovelia* from N9468A, narrow parallel stream with sand bottom, mostly c. 2-5m wide, 54♂ 45♀ apt., 5♂ 8♀ macr., 5 lvv.; Sungai Kendahe, bridge at Poto, mountain stream, 17.XI.1994, N9471. Medium sized, fast flowing stream, bottom coarse pebbles, width 3m, at bridge much wider, and slower (spot extensively used for washing cloth), specimens taken from quiet bays at edges of stream, 16♂ 10♀ apt., 11♂ 7♀ macr.; N. side, near Poto, stream, 17.XI.1994, N9472. Small mountain stream through overgrown coconut grove, some boulders, bottom pebbles, some plant debris, water clear, hyaline, 12♂ 12♀ apt. (3♂ 3♀ OXUM, 2♂ 2♀ USCP); N. side, near Poto, stream, 17.XI.1994, N9473. Mountain stream, narrower and quieter than N9471, some boulders, bottom small pebbles, coarse sand, 15♂ 8♀ apt., 2♂ 1♀ macr., 6 lvv.; Small stream at Kampung Lapango-Hakadele (near Desa Sawaeng), 18.XI.1994, N9474. Mountain stream, sample from slowly flowing rather flat part. Bottom with some mud. *Ipomoea* growing into the water which has a bluish tinge (soap ?), 76♂ 92♀ apt., 13♂ 17♀ macr., 2 lvv.; Sungai Makariahe, near Gunung, 19.XI.1994, N9478. Upper reaches of mountain stream, more or less a trickle of water between boulders, some small pools from which the sample was taken, 1♂ 1♀ apt., 1♀ macr.; E. side, Sungai Miulu, 20.XI.1994, N9480, 7♂ 9♀ apt., 1♀ macr., 2 lvv.

**Description.** – Apterous form. A medium sized rather broad and generally dark species. Dimensions. Length ♂ 3.20-3.28, ♀ 3.38-3.50; width (at base of abdomen) ♂ 1.23-1.28, ♀ 1.35-1.38; width of head ♂ 0.80-0.82, ♀ 0.82-0.85; width of pronotum ♂ 1.11-1.15, ♀ 1.13-1.18.

Colour generally dark grey to black, juga and basal part of rostrum lighter, narrow anterior transverse band anteriorly on pronotum (reaching laterally halfway eyes) orange-yellow, covered with grey pruinosity which becomes more distinct laterally. Outer rim of connexiva brownish, not very contrasting, in most specimens best visible on segments 3-6. Basal half of first antennal segment and fore femur, basal third ventrally, basal sixth dorsally of hind femur, acetabula, coxae and trochanters pale.

Minute black denticles spreading from prosternum to propleura reaching just behind eyes, moreover some on jugae and acetabula especially dorsally on metacetabulum. Meso- and metapleuron in anterodorsally of acetabulum with distinct punctures

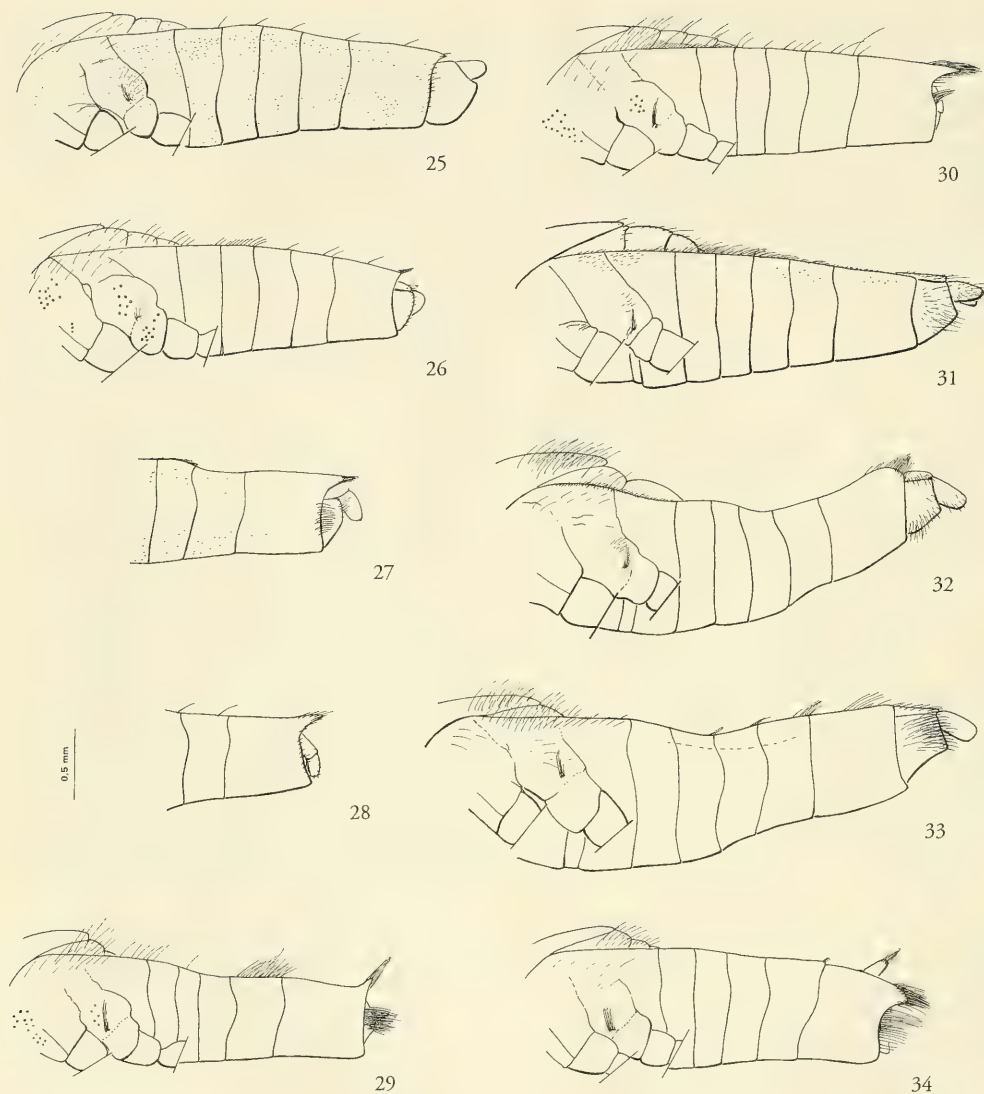
(fig. 30). Dorsum, apart from the normal fine pubescence clothed with long erect bristles, sparse or absent on disk of pronotum and, especially in female, on caudal abdominal segments. Punctures on posterior three quarters of pronotum indistinct (with ill-defined margins and covered by relatively dense pubescence). Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae.

Length of antennal segments (male and female) I : II: III : IV 0.81 : 0.40 : 0.49 : 0.50. Pronotum long, covering mesonotum, length : width 0.90 : 1.13. Length of metanotum on middle line, 0.10. Abdominal tergites 1-5 subequal in length (0.20), tergite 6 slightly longer, 0.25 in male to 0.30 in female, tergite 7 0.40.

Male. Posterior trochanter with 2-5 small but distinct blunt teeth. Posterior femur 2.7 times as long as wide (1.34/0.50), Ventral margin in proximal third with about 10-15 minute and closely set teeth followed by a row of 9-11 larger spines decreasing in size, of which the first (proximal) is nearly half as long as the width of femur (fig. 4). In addition two or three smaller spines located in distal part ventrally of the main row. Larger spines black tipped, smaller spines and teeth entirely black or nearly so. Posterior tibia virtually straight, armed beneath with a double row of about 30 rather coarse pegs. Connexiva usually horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 less than its median length (0.30/0.40); (exposed part of) tergite 8 as wide as long (0.30) Abdominal sternites 2-6 of subequal length (0.2), sternite 7 longer (0.35) ventrally flattened with a low keel, sternites 5-6 with median tufts of bristles. Parameres as in fig. 38.

Female. Posterior trochanter without small teeth. Posterior femur three and a quarter times as long as wide (1.32/0.4), proximal row of minute teeth or replaced by up to three coarser teeth, larger spines about eight in number and except for the first shorter than in male, two to three more ventral spines present. Pegs on posterior tibia nearly covered by the tibial pilosity. Connexiva more or less horizontal to slanting upward to 0.15π. Converging caudally in a nearly straight line (fig. 17), leaving most of tergites uncovered, apices pointed, accentuated by a tuft of caudally directed bristles in addition a smaller tuft of bristles more ventrally on hind margin of segment 7 (fig. 30). Position of tergite 8 and proctiger slanting nearly vertically ventrad. Sternite 7 about twice as long as sternite 6 (0.30/0.60) median length of remaining abdominal sternites about 0.2. Gonocoxa hidden in segment 7.

Macropterous form. – Essentially as apterous form except for development of hemielytra and thorax. Length 3.3-3.4, humeral width of pronotum 1.38-



Figs. 25-34. Lateral view of abdomen (27-28 caudal segments only) of apterous females of *Rhagovelis*: 25 *R. ochra*, 26 *R. achna*, 27 *R. krama*, 28 *R. abra*, 29 *R. tsouloufi*, 30 *R. skoura*, 31 *R. sterea*, 32 *R. gyrsta*, 33 *R. plichona*, 34 *R. cylindros*.

1.42, median length of pronotum 1.20-1.30. Pronotum black with a sharply contrasting orange-yellow transverse band at anterior margin, sometimes covered with whitish pubescence. Hemelytra reaching 0.2 beyond apex of abdomen, dark brown with black veins. A pair of elongate proximal cells marked with sordid white bands, reaching slightly beyond halfway hemelytron, a pair of shorter central cells,

outer one (near costal margin) reaching to one fourth from apex, inner one to one third from apex of hemelytron. Keels on base of abdomen strongly developed, reaching to caudal margin of tergite 3. Brownish rim of connexiva (partly not covered by hemelytra) more strongly developed than in apterous form, a shining brownish patch on tergite 7.

Etymology. – Skouros, greek adjective meaning dark, referring to the generally dark colour compared to its nearest relatives.

Comparative notes. – See key, general shape similar to *R. wallacei*, including the tufts of bristles on sternites 5 and 6 of male, but this species has the yellowish transverse band of pronotum broad, reaching to propleurae and the long erect bristle-like hairs dorsally restricted to connexiva.

*Rhagovelia tsouloufi* sp. n.  
(figs. 9, 19, 18, 29, 39, 44)

Type material. – Holotype apterous ♂ (RMNH) INDONESIA: Sulawesi Utara, Pulau Salibabu, Sg. Musi, downstream stretch in agricultural area, quiet, shallow, mostly 2-3m wide and 0.05-0.1m deep, bottom pebbles, stones and a few boulders, water clear, hyaline, N9489, 26 Nov. 1994, leg. N. Nieser (fig. 44). – Paratypes (NCTN unless otherwise indicated): Same data as holotype 35♂ 13♀ apterous, 7♂ 5♀ macropterous distributed as follows: 3♂ 2♀ apt., 1♂ 1♀ macr. NHMW; 2♀ (including allotype) apt., 1♂ macr. RMNH. – Additional paratypes, all leg. N. Nieser: P. Salibabu, Lirung, narrow stream on rocks, very steep, draining small marsh on top of hill (c. 350 m asl), various shallow pools with much plant debris connected by trickles of water, shaded by remnants of (? primary) forest, N9483, 24. XI. 1994, 6♂ 4♀ apt., 1♂ macr. (1♂ macr. JTPC, 3♂ 3♀ OXUM, 2♂ 1♀ USCP); Pulau Karakelong, D(esa) Ambela, at inlet of irrigation system, 30.XI.1995, N9493. Sungai Ambela, broad river bed with sand & pebbles, with little water. One side still forested, other side disturbed, 13♂ 4♀ apt., 1♂ macr. (JTPC 3♂ 1♀, MBBJ 2♂ 1♀ apt. 1♂ macr., MUDH 1♂ 1♀, SEMC 2♂, ZMAN 2♂ 1♀. P. Karakelong, Sungai Ambela at waterfall, 2.xii.1994, pool slightly downstream in lowland rain forest, N9497A, 45♂ 26♀ apt. P. Karakelong, Sungai (at) Sawang, 3.xii.1994, N9498. Lowland stream trough agricultural (small scale) area, light brown very turbid (after rain), 2♂ 4♀ apt., 2♂ 2♀ macr., 1 lrv.

Description. – Apterous form. Rather small generally dark species. Dimensions. Length ♂ 2.89-3.08, ♀ 3.28-3.48; width (across base of abdomen) ♂ 1.08-1.12, ♀ 1.15-1.23; width of head ♂ 0.72-0.75, ♀ 0.75-0.80; width of pronotum ♂ 0.93-0.98, ♀ 1.01-1.10.

Colour generally dull dark brown to grey, eyes dark castaneous, yellowish transverse band anteriorly on pronotum distinctly contrasting, narrow, reaching slightly beyond the inner margins of eyes. Basal half of antennal segment 1, acetabula, coxae, trochanters, proximal three quarters of anterior femur and proxi-

mal one third of hind femur pale. Connexiva with a narrow orange-brown rim. Venter and sides and lateral parts of first tergites in female somewhat pruinose grey. Minute black denticles present on anterolateral angles of pronotum, due to grey back ground rather indistinct. Row along anterior margin and posterior three quarters of pronotum distinctly punctured, pro- and meso-pleura with well-developed coarse punctures. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body clothed with short pubescence, virtually absent laterally in females, superimposed by sparse longer bristles in males which are hardly developed in females.

Length of antennal segments (♂, ♀) I : II : III : IV 0.72 : 0.39 : 0.49 : 0.42. Pronotum long, covering mesonotum, shorter than wide (♂ 0.80/0.96, ♀ 0.85/1.05). Length of metanotum on midline, 0.1. Abdominal tergites 1-6 in male, 1-5 in female subequal in length (0.15-0.20), tergite 7 in male 0.40 tergite 6 in female 0.35, tergite 7 0.50. Abdominal sternites 2-5 in male, 3-5 in female subequal, about 0.15 long. In male sternite 6 slightly longer 0.20, sternite 7 distinctly longer, 0.35; in female sternite 2 0.20, 6 0.30 and 7 0.6.

Male. Posterior trochanter with 1-4 small black teeth. Posterior femur incrassate, on average slightly over two and a half times as long as wide (1.26/0.48). Ventral (inner) margin with 8-10 very small black teeth in proximal third, followed distally by a double row of spines, the posterior (dorsal) row consisting of about 12 spines of apically decreasing spines, the larger spine about one third as long as the width of femur. The anterior (ventral) row consisting of about six smaller spines (fig. 10). Posterior tibia virtually straight, armed beneath with a, proximally double distally single row of 24-30 small teeth which are partly covered by the pilosity of the femur. Connexiva more or less horizontal to slanting slightly upward (about 0.15π), gradually converging posteriorly. Abdominal tergite 7 bare, shining, its basal width three quarters its median length (0.30/0.40). Tergite 8 basally as wide as long (0.30). Abdominal sternite 7 brownish flattened, with a faint indication of a median keel only. Sternites 8 and 9 medium brown, sternite 8 flattened without keel. Parameres stout (fig. 39).

Female. Middle femur distinctly and broadly dorsoventrally compressed halfway its length. Posterior trochanter without small teeth. Posterior femur with a narrow part in proximal third ('petiolate') remainder less incrassate than in male, slightly over three times as long as wide (1.17/0.37); its armament restricted to a single row of about seven distally decreasing spines in distal two thirds, of which the largest is about half as long as the width of femur (fig.



9). Posterior tibia armed with an irregular inner row of about 25 small spines largely hidden in the pilosity of the tibia. Connexiva more or less vertical, curving inward over segments 4-5, strongly converging on segments 6-7, meeting over abdomen on posterior half of segment 7 (fig. 18) including the upwards pointing caudal connexival angles which are accentuated by some bristles (fig. 29). The dorsal part of the caudal margin of segment 7 accentuated by a dense fringe of large bristles. Tergites 8 and 9 vertical, only visible in caudal view. A tuft of erect somewhat caudally pointed golden brown bristles on laterosternite 4. Sternites 5-7 flattened.

Macropterous form. – Essentially as apterous form except for development of wings and thorax. Length ♂ 3.20-3.38, ♀ 3.48-3.55, humeral width of pronotum ♂ 1.30-1.34, ♀ 1.37-1.42, median length of pronotum ♂ 1.20-1.30, ♀ 1.26-1.40. Pronotum black, orange-yellow transverse band at anterior margin reaching slightly beyond inner margins of eyes, rather indistinct due to cover by whitish pubescence. Propleura with a distinct row of punctures near ventro-posterior margin. Hemelytra reaching apex of abdomen in males and about 0.1 beyond apex of abdomen in females, brown to dark grey with darker veins. A pair of elongate proximal cells marked with sordid white (especially the one at costal margin) reaching halfway hemelytron, a pair of distal cells of which the one near costal margin is distinctly smaller reaching two thirds the length of hemelytra. Dorsum of abdomen castaneous, brownish rim of connexiva broader than in apterous form, keels on base of abdomen well developed and long, reaching to the base of tergite 4. Connexiva of female sinuate, slanting upward nearly  $0.4\pi$ .

Etymology. – Tsouloufi (tsoulouphi), Greek noun meaning tress (of hair), referring to various tufts of bristles on abdomen in female.

Comparative notes. – Apparently related to *R. trichota* Nieser & Chen and *R. minahasa* Polhemus & Polhemus females of which have the caudal part of connexiva more or less folded over abdomen, the characteristics in the key will serve to separate these species.

### The *R. gyrista*-group

Diagnosis: Medium sized to rather large *Rhagovelia*, length 3.6-4.1 mm, ground colour dark grey to black, body dorsally and antennae with conspicuous golden pubescence. Posterior femur in males slender, proximal granulate teeth rather large. Posterior femur in females dorsoventrally flattened. Dealate specimens relatively common, basal abdominal carinae (only observed in *R. gyrista*) in macropters broad and low, reaching to posterior margin of tergite 2.

Distribution: Endemic to Sulawesi.

*R. hamjadi* Polhemus & Polhemus (1988) was originally placed in the *R. papuensis*-group. In view of the above mentioned characteristics which it shares with *R. gyrista* we consider these two to form a separate group within the genus. *R. sterea* sp. n. so far only known by the unique apterous female holotype is included in this group because of its similarity to *R. hamjadi*.

### Key to species of the *R. gyrista* group (apterous specimens)

1. Orange-yellow transverse band anteriorly on pronotum wide, connected with the similarly coloured pleurae ..... *R. sterea* sp. n.
- Orange-yellow transverse band anteriorly on pronotum narrow, reaching to inner margins of eyes, propleurae dark ..... 2
2. Male, posterior femur proximally with a row of about 16 granulate teeth, distally with a row of six spines, abdomen strongly curved upwards caudally (fig. 32), connexiva bent inward and folded over lateral parts of abdominal tergites 3-6 (fig. 22) ..... *R. gyrista*
- Male, posterior femur proximally with a row of about 20 granulate teeth, distally with a row of 8-9 spines. Female, abdomen straight, connexiva not folded over abdomen, their margin only slightly concave ..... *R. hamjadi*

### *Rhagovelia gyrista* sp. n.

(figs. 11, 12, 22, 32, 41, 45)

Type material. – Holotype, apterous ♀ (ZMAN), INDONESIA: Sulawesi Selatan: SW Sulawesi, Mamasa, Sg. Loko, 1400m, 17 Nov 1993, leg. J. P. & M. J. Duffels (fig. 45). – Paratypes, same data as holotype, 1 ♂ (allotype) 2 ♀ apt., 2 ♂ 1 ♀ macropterous ZMAN (1 ♂ macr., 1 ♀ apt. NCTN). The macropters have the wings entirely broken off except for some remnants at the humeral angles of pronotum (dealate); Sulawesi Selatan: Zuid Celebes, Nanggala, 800m, Rantepao, VIII. 1937, leg. F. C. Drescher, 1 ♂ apt. (BMNH)

Description. – Apterous specimens. Dimensions length ♂ 3.93, ♀ 4.07-4.11; width (across base of connexiva) ♂ 1.30, ♀ 1.45-1.51; width of head ♂ 0.90, ♀ 0.90-0.91; width of pronotum ♂ 1.12, ♀ 1.29-1.30. Colour generally dark grey to blackish. Orange-yellow transverse band anteriorly on pronotum narrow, reaching the inner margins of eyes. Basal third of first antennal segment, acetabula, coxae and trochanters, basal half to two thirds of anterior femur and basis of hind femur, yellow. Outer rim of con-

nexiva narrowly brown in females, not obvious in male. Venter dull dark grey to black, sternites 7-10 brownish. Minute black denticles restricted to jugum and inner faces of fore and middle acetabula. Interoculus, thoracic and abdominal tergites clothed with dense appressed golden-yellow pilosity much more developed and distinct in male than in females. In addition dorsum of thorax and abdomen with sparse long erect dark cilia. Vertex sides of thorax, antennae and legs with the usual pubescence and setae.

Length of antennal segments (no apparent differences between male and female) I : II : III : IV 0.97 : 0.45 : 0.74 : 0.62. Pronotum long, covering mesonotum. Disk of pronotum with some indistinct punctures, obscured by pilosity, in posterior part. Length: width of pronotum about 1.2 ( $\delta$  1.28 / 1.05,  $\eta$  1.50 / 1.17). Length of metanotum on midline, 0.10. Abdominal tergites 1-6 in male subequal in length (0.20), in female becoming gradually longer posteriorly, (from 0.22-0.30) but mostly covered by connexiva. Tergite 7 over twice as long as preceding tergites in male (0.45); 1.5 times as long as preceding in female (0.45/0.30).

Male. Posterior trochanter length: width 0.4 : 0.2, without teeth or warts. Posterior femur slender, five times as long as wide (1.5/0.3), on ventroposterior margin about halfway with a rather small spine, its length about one sixth the width of femur, with a row of about seven spines of gradually decreasing length distally (fig. 11). Posterior tibia straight, armed beneath with a row of about 20 short stout teeth giving a serrate impression (fig. 11). Connexiva slanting upward about  $0.25\pi$  or somewhat less, virtually parallel on segments 1-5 strongly converging posteriorly on segments 6-7, no caudal points. Basal width of abdominal tergite 7 less than 1.5 times its median length (0.55/0.45). Abdominal sternite 7 comparatively short, about 1.2 times as long as sternite 6 (0.30/0.25), sternite 6 somewhat, sternite 7 distinctly flattened medially, without a carina. Genital segments prominent (fig. 7), fusiform, tergite 8 longer than tergite 7 (0.55/0.45). Sternite 8 laterally compressed at base, resulting in a low broad carina ventrally. Median length of pygophore equal to median length of sternite 8 (0.30). Parameres as in fig. 41.

Female. Posterior femur six times as long as wide (1.5/0.25). Posterior femur and tibia without teeth or spines (fig. 12). Connexiva strongly curved inwards, folded over abdomen leaving on tergites 3-6 only a narrow median strip uncovered (fig. 22). Caudal apex of connexiva truncate with distinct tufts of pilosity; gonocoxae 1 (sternite 8) laterally with well-developed pilosity which anterolaterally forms additional tufts (fig. 22). Tergite 8 nearly horizontal, as long as tergite 7 (0.45) (fig. 32). Sternite 7 large, about two fifth

the length of the preceding abdominal sternites together (0.6/1.5). Gonocoxa clearly visible, about half the length of sternite 7, ventrally compressed, the sides reaching further ventrally than the flattened to somewhat impressed ventral part, forming a pair of lateral ridges. Proctiger large.

Macropterous form. Mostly as apterous except for modifications of the thorax and presence of wings. Dimensions, length  $\delta$  4.80-5.08,  $\eta$  4.92-5.18, hemielytra reaching 0.55-0.67 beyond the apex of abdomen; humeral width of pronotum  $\delta$  1.75-1.80,  $\eta$  1.85-1.90, median length of pronotum  $\delta$  1.71-1.78,  $\eta$  1.75-1.85. Hemielytra dull dark grey to blackish, veins only slightly darker, forming two elongate basal and two more or less squared apical cells. Hind wings dark smoky brown-grey. Laterobasal quarter of hemielytra with golden-yellow pubescence, golden-yellow pubescence on abdominal dorsum restricted to a median band. Pronotum with obtuse humeral angles and a rounded caudal apex. Metanotum with a pair of sublateral pits. Second abdominal tergite with a transverse pitted groove, longitudinal carinae not developed. Caudal tufts of bristles on female abdomen less prominent than in apterous form.

**Etymology.** – *Gyristos*, a Greek adjective meaning curved refers to the general body form in females.

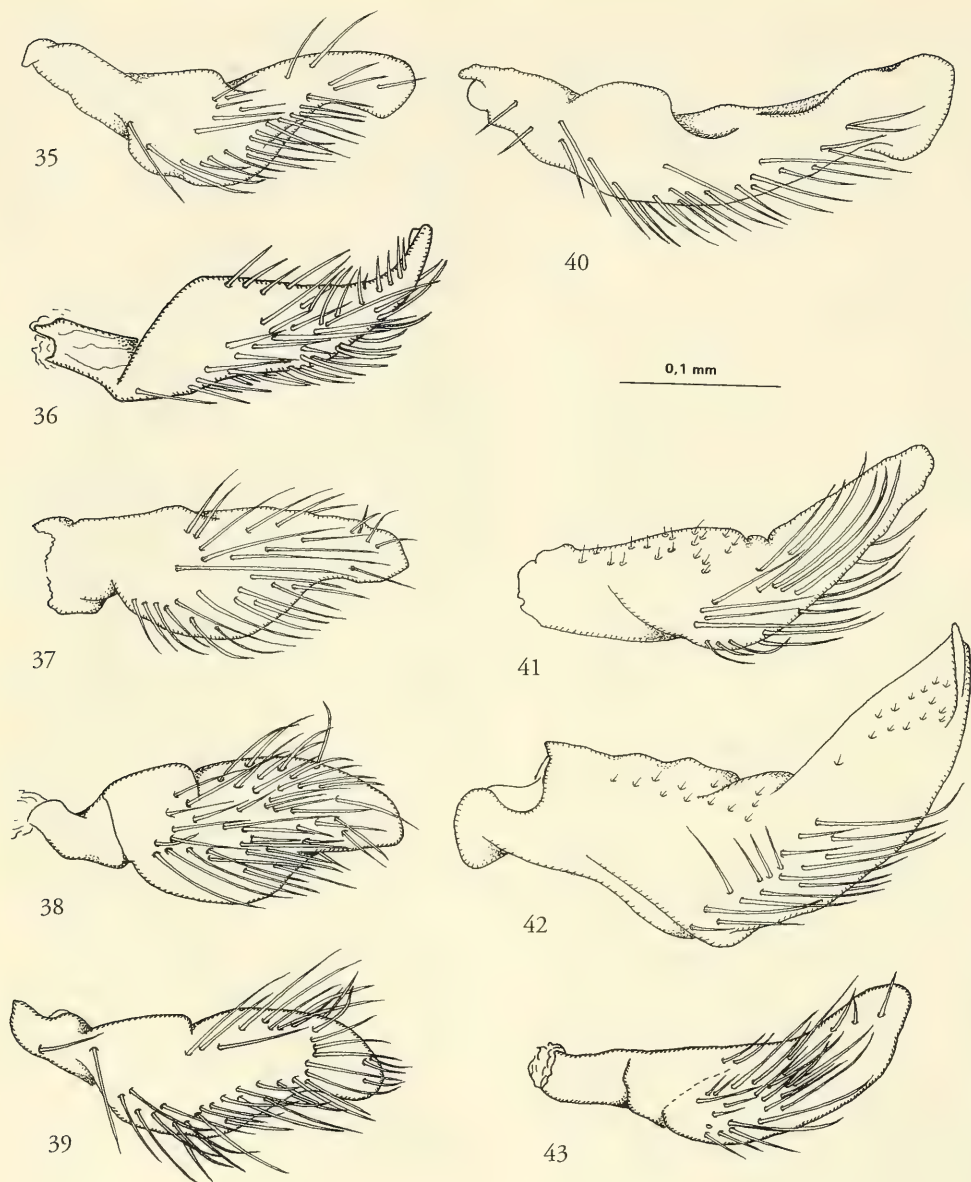
**Comparative notes** (see keys). – In view of its size combined with striking golden pubescence dorsally the Sulawesi species which look similar belong to the *R. gyrista* and *plychona* groups. The curved abdomen of the female is at once characteristic (actually the characteristic body form of females was the reason to choose a female as holotype). *R. plychona* females have, apart from the leg characteristics separating the groups, the abdomen less distinctly curved and very distinct tufts of bristles on the gonocoxae. Males of *R. gyrista* can be recognized by the characteristics mentioned in the keys. In the key by Nieser & Chen (1993) *R. gyrista* runs to *R. chrysomalla* which, however, belongs to the *R. plychona*-group.

***Rhagovelia sterea* sp. n.**  
(figs. 23, 31, 45)

**Type material.** – Holotype (unique specimen), apterous  $\eta$  (ZMAN), INDONESIA: SW Sulawesi, Mamasa, Sg. Loko, 1400m, 17 Nov 1993, leg. J. P. & M.J. Duffels (fig. 45).

**Description.** – Apterous female. Dimensions length 3.92, width (across base of connexiva) 1.40, width of head 0.88, width of pronotum 1.25.

Colour generally dark brown-grey to blackish. Anterior fifth of pronotum, propleura and prosternum orange-yellow anterior margin of pronotum



Figs. 35-43. Parameres of *Rhagovelia*: 35 *R. abra*, 36 *R. achma*, 37 *R. krama*, 38 *R. skoura*, 39 *R. tsouloufi*, 40 *R. ochra*, 41 *R. gyrsta*, 42 *R. phychona*, 43 *R. cylindros*.

narrowly dark, reaching halfway eyes. Jugae, basal fourth of first antennal segment, acetabula, coxae and trochanters, basal third of anterior femur laterally and most of its anterior ('under') surface orange-yellow.

Anterior surface of middle and hind femur brownish, depending on incidence of light accentuated by pale pilosity. Outer rim of connexiva, abdominal sternite 7 and most of gonocoxae brown. Venter dull dark



grey to black. Minute black denticles spreading from jugum and prosternum through propleurae to anterolateral parts of pronotum. Body dorsally clothed with short, not very dense golden pilosity, ventral pilosity somewhat longer and denser, yellowish. Vertex, sides of thorax, antennae and legs (except middle and hind femur) with the usual pubescence and setae.

Length of antennal segments I : II : III : IV 0.90 : 0.43 : 0.70 : 0.50. Pronotum long, covering mesonotum. Disk of pronotum with many relatively small punctures. Length: width of pronotum about 0.9 (1.10/1.25). Length of metanotum on midline, 0.10. Abdominal tergites 2-5 subequal in length (0.20), tergites 1 and 6 0.30, tergite 7 0.40.

Posterior trochanter length : width 0.35 : 0.16, without teeth or warts. Posterior femur slender, slightly over five times as long as wide (1.3/0.25), on posterior margin in apical part three small teeth. Posterior tibia straight without teeth. Connexiva vertical, strongly converging on segments 1-4, curved inward on segments 4-5 and slightly convex on segments 6-7, without caudal points or pilosity (fig. 23). Tergites 8 and 9, however, with some bristles partly combined in a tuft. Basal width of abdominal tergite 7 1.25 times its median length (0.50/0.40). Tergite 8 horizontal, as long as tergite 7 (0.40), proctiger fully visible, pointing caudally. Sternite 7 large, slightly less than half as long as the preceding abdominal sternites together (0.6/1.3). Gonocoxa extended, clearly visible, about half the length of sternite 7, ventrally slightly compressed, caudally distinctly hairy (fig. 31).

Male and macropterous form unknown.

Etymology. — Stereos, a Greek adjective meaning solid or stout, refers to the stout build of this species compared to most other *Rhagovelia*.

Comparative notes (see keys). — In the key to groups this species runs to the *gyrista*-group by the structure of the female hind femur which is similar to that of *R. hamjadi* Polhemus & Polhemus, which has also a similar general shape. *R. hamjadi* has, however, the anterior orange band on pronotum narrow, reaching inner eye margins, and is slightly smaller. *R. sterea* has the dorsal golden pubescence less developed than related species.

### The *R. plychona*-group

Diagnosis: Large *Rhagovelia*, length 3.8-4.4 mm, ground colour dark grey to blackish, body dorsally with golden pubescence. Posterior legs slender, femur of male without proximal granulate teeth, femur of female not distinctly flattened. Hemielytra unicolorous, hairy in latero-proximal quarter, with four closed cells. Basal dorsal carinae of abdomen in macropterous form not developed.

Distribution: Endemic to Sulawesi.

Remarks. In general habitus, golden pubescence dorsally and slender hind legs the *R. gyrista* and *R. plychona* groups are quite similar. The structural characteristics of the hind legs and basal carinae on abdomen of macropterous form are, however, quite different. Unfortunately no specimen with complete hemielytra is known from the *R. gyrista*-group. *R. chrysomalla* Nieser & Chen (1993) provisionally placed with the *R. papuensis* group by the authors has to be transferred to the *R. plychona*-group.

### Key to species of the *R. plychona* group (apterous specimens)

1. Yellow anterior transverse band of pronotum connected with the yellowish propleurae (in some specimens dark spots behind the eyes), connexiva broadly yellowish. Connexiva of female straight, not folded over tergites, abdomen not curved upward, gonocoxae without tufts of long bristles ..... *R. chrysomalla*
- Yellow anterior transverse band on pronotum narrow, at most reaching halfway eyes, propleura dark, connexiva narrowly yellowish brown. Connexiva of female curved inward and folded over tergites (fig. 24), abdomen curved upward (fig. 33), gonocoxae with distinct tufts of long bristles (fig. 24) ..... *R. plychona*

### *Rhagovelia plychona* sp. n.

(figs. 13, 14, 24, 33, 42, 45)

Type material. — Holotype, apterous ♂ (ZMAN), INDONESIA: SW Sulawesi, Karangan, ca. 30 km NE of Enrekang, 1450m, gardens, 10-11 Nov. 1993, leg. J. P. & M. J. Duffels (fig. 45). — Paratypes (adults only) with same data as holotype: 34♂ 20♀ apt., 20♂ 20♀ macr., 22lvIV/V distributed as follows: 1♂ apt., 1♂ macr. JTPC; 1♂ 1♀ apt., 1♂ 1♀ macr. MBVJ; 3♂ 3♀ apt., 3♂ 3♀ macr. NCTN; 2♂ 2♀ apt., 2♂ 2♀ macr. NHMW; 1♂ 1♀ apt., 1♀ macr. OXUM; 1♂ 1♀ apt., 1♂ 1♀ macr. SEMC, remaining specimens including allotype apt. ♀ in ZMAN. — Additional paratypes (adults only): SW, Sulawesi, ca. 30 km NE of Enrekang, Gowa camp. Pos 2. 6-9 Nov. 1993, 3°24'15"S 120°00'30"E. Gunung Rantemario, Sg. Gowa Sarumpa'pa. River through undistd. lower montane forest, w=3-4m, 1800 m asl. J. van Tol, 3♂ 2♀ apt. 12 lvIV/V (RMNH).

Description. — Apterous form. Dimensions. Length ♂ 4.05-4.16, ♀ 4.30-4.42; width ♂ 1.40-1.48, ♀ 1.62-1.68; width of head ♂ 0.93-0.97, ♀ 0.96-1.01; width of pronotum ♂ 1.25-1.31, ♀ 1.48-1.52.



Fig. 44.

Localities of new species of *Rhagovelia*: The more important islands between Sulawesi (Sul), Indonesia and Mindanao (Min), Philippines: Si Siau, Sa Sangihe, type locality of *R. cylindros* and *R. skoura*; Sb Salibabu, type locality of *R. tsouloufi*, Ka Karakelong additional localities of *R. tsouloufi*.

Colour dark grey to blackish, eyes castaneous. Orange-yellow transverse band anteriorly on pronotum narrow, reaching the inner margins of eyes. Basal third of first antennal segment, acetabula, coxae and trochanters (middle trochanter slightly infuscated), basal half to two thirds of anterior femur and in some specimens basis of hind femur, pale. Outer rim of connexiva brown, more distinctly in female than in male. Venter dull dark grey to black, sternites 7-10 brownish in most specimens.

Minute black denticles restricted to jugum and proepisternum. Interoculus, thoracic and abdominal tergites clothed with dense appressed golden-yellow pilosity (this golden pilosity is also present in larva V). In addition dorsum of thorax and abdomen with sparse long erect dark cilia. Vertex sides of thorax, antennae and legs with the usual pubescence and setae except for hind femur and tibia in male which are clothed with long hairs.

Length of antennal segments (no apparent differences between male and female) I : II : III : IV 0.97 : 0.45 : 0.74 : 0.62. Pronotum long, covering mesonotum. Disk of pronotum with some indistinct punctures, obscured by pilosity, in posterior part. Length: width of pronotum about 1.2 ( $\delta$  1.28/1.05,  $\eta$  1.50/1.17). Length of metanotum on midline, 0.10. Abdominal tergites 1-6 in male subequal in length (0.20), in female becoming gradually longer posteriorly, (from 0.22-0.30) but mostly covered by connex-

iva. Tergite 7 over twice as long as preceding tergites in male (0.45); 1.5 times as long as preceding in female (0.45/0.30).

Male. Posterior trochanter length: width 0.4: 0.2, without teeth or warts. Posterior femur slender, five times as long as wide (1.5/0.3), on ventroposterior margin about halfway with a rather small spine, its length about one sixth the width of femur, with a row of about seven spines of gradually decreasing length distally (fig. 13). Posterior tibia straight, armed beneath with a row of about 20 short stout teeth giving a serrate impression. Connexiva slanting upward about  $0.25\pi$  or somewhat less, virtually parallel on segments 1-5 strongly converging posteriad on segments 6-7, no caudal points. Basal width of abdominal tergite 7 less than 1.5 times its median length (0.55/0.45). Abdominal sternite 7 comparatively short, about 1.2 times as long as sternite 6 (0.3/0.25), sternite 6 somewhat, sternite 7 distinctly flattened medially, without a carina. Genital segments prominent (fig. 7), fusiform, tergite 8 longer than tergite 7 (0.55/0.45). Sternite 8 laterally compressed at base, resulting in a low broad carina ventrally. Median length of pygophore equal to median length of sternite 8 (0.3). Parameres as in fig. 42.

Female. Posterior femur six times as long as wide (1.5/0.25). Posterior femur and tibia without teeth or spines (fig. 14). Connexiva strongly curved inwards, folded over abdomen leaving on tergites 3-6 only a

narrow median strip uncovered (fig. 24). Caudal apex of connexiva truncate with little pilosity at the tip, however, gonocoxae 1 (sternite 8) distinct tufts of rather long bristles (fig. 33). Tergite 8 nearly horizontal, as long as tergite 7 (0.45). Sternite 7 large, about two fifth the length of the preceding abdominal sternites together (0.6/1.5). Gonocoxa clearly visible, about half the length of sternite 7, ventrally compressed, dorsally with a distinct tuft of bristles. Proctiger distinctly visible.

Macropterous form. Mostly as apterous except for modifications of the thorax and presence of wings. Dimensions, length ♂ 4.80-5.08, ♀ 4.92-5.18, hemielytra reaching 0.55-0.67 beyond the apex of abdomen; humeral width of pronotum ♂ 1.75-1.80, ♀ 1.85-1.90, median length of pronotum ♂ 1.71-1.78, ♀ 1.75-1.85. Hemielytra dull dark grey to blackish, veins only slightly darker, forming two elongate basal and two more or less squared apical cells. Hind wings dark smoky brown-grey. Laterobasal quarter of hemielytra with golden-yellow pubescence, golden-yellow pubescence on abdominal dorsum restricted to a median band. Pronotum with obtuse humeral angles and a rounded caudal apex. Metanotum with a pair of sublateral pits, second abdominal tergite with a transverse pitted groove, longitudinal carinae not developed. Abdomen of female not curved upwards and with caudal tufts of bristles less prominent than in apterous form.

Etymology. – Plynchos, greek adjective meaning pleated, refers to the connexiva folded over dorsum in apterous females of this species.

Comparative notes (see keys). – In view of their general shape and dorsal golden pilosity the species of the *R. gyrsta* and *R. plynchona* groups are superficially similar. Especially females of *R. plynchona* and *R. gyrsta* look somewhat similar at first glance but are easily distinguishable by inspection of the leg characteristics separating the groups. In addition the curvature of the abdomen and the position of the connexiva are also somewhat different (figs. 22, 24, 32, 33). Other species can also be separated by the characteristics mentioned in the group and species keys. In addition the parameres of *R. chrysomalla* are very slightly broader than those of *R. plynchona* but this is only recognizable when specimens are compared. The swollen caudal part of the proctiger is relatively longer in *R. chrysomalla* than in *R. plynchona* (length flat basal part/ length swollen apical part 0.34/0.42 and 0.40/0.36 respectively).

### The *Rhagovelia orientalis*-group

Diagnosis: Small or medium sized, length up to 3.7 mm, body generally squat, outlines of abdomen strongly convergent caudally\*. Females not or only

slightly larger than males. Body colour completely black (except in *R. kastanoparuphe*), except for a small orange spot on anterior part of pronotum. Legs black, usually with a metallic shimmer\*, only basal parts yellow in some species, middle and hind femur completely black in most of the species. Jugs and proepisterna without black spicules. Pronotum long in apterous specimens, covering the mesonotum. Fore wing of macropterous specimens with three or four closed cells, the distal cells reaching the apical third of the wing. Dealate specimens common\*. Abdominal carinae of macropterous specimens reaching the hind margin of tergite 2 at most\*. Hind trochanter without teeth or granules, with dense pilosity\*. Hind femur of male slightly to moderately thickened, generally with a distal row of teeth, proximally without teeth or granules. Parameres short, crescent-shaped in most of the species. Abdomen with modifications in most of the species, dorsally in females and ventrally in males.

Discussion: This species group is a clearly monophyletic group based on several diagnostic characters (proposed synapomorphies marked with \* in diagnosis). It shows the close zoogeographical relations between the Philippines and Sulawesi. Twenty species are known, 14 from the Philippines (Zettel 1995), five from the main island of Sulawesi (Nieser & Chen 1933), and one from Sangihe Isle.

Distribution: Philippines (except Palawan), Sulawesi.

### Key to the species of Sulawesi and adjacent islands (apterous specimens and macropterous males)

1. Females ..... 2
- Males ..... 8

#### Females

2. Hind margin of tergite 7 with a long, finger-like process (fig. 34) ..... 3
- Hind margin of tergite 7 straight or with a short, triangular process ..... 5
3. Process on tergite 7 directed backward, tergite 8 with two distinct tufts of hairs in its posterior corners ..... *R. sulawesiana*
- Process on tergite 7 directed upward, tergite 8 without distinct tufts of hairs ..... 4
4. Hind margin of sternite 7 laterally with long black hairs (fig. 34) ..... *R. cylindros*
- Hind margin of sternite 7 laterally without long hairs ..... *R. daktylophora*
5. Hind margin of tergite 7 straight . *R. celebensis*
- Hind margin of tergite 7 with a small hairy process in middle or broadly protruding .... 6
6. Connexiva and middle of sternite 7 brown, process of connexivum very long, hind margin of



Fig. 45.

Sulawesi proper: 1 *R. achna*,  
2 *R. abra*, 3 *R. krama* and  
*R. ochra*, 4 *R. gyrsta* and *R.*  
*sterea*, 5 *R. gyrsta*, *R. ply-*  
*chona*.



J. oul  
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tergite 7 broadly triangular . . . *R. kastanoparuphe*

- Connexiva and middle of sternite 7 in fully developed specimens black . . . . . 7
- 7. Process of connexivum short, but with long hairs, hind margin of tergite 7 with a very short, hairy process in middle . . . . *R. pseudocelbensis*
- Process of connexivum long, acute, process of tergite 7 generally longer . . . . . *R. daktylophora*

#### Males

- 8. Sternites without conspicuous long pilosity, middle and hind femur basally yellow, connexiva brown, paramere distally truncate . . . . . *R. kastanoparuphe*
- Sternites with conspicuous long hairs, middle and hind femur black, connexiva black, parameres distally rounded or pointed . . . . . 9
- 9. Sternite 6 carinate, long pilosity restricted to this carina . . . . . *R. daktylophora*

- Sternite 6 not carinate, pilosity different . . . 10
- 10. On sternite 5 and 6, pilosity laterally longer than along median line . . . . . *R. cylindros*
- On sternite 5 and 6, pilosity along median line as long as or longer than laterally . . . . . 11
- 11. Sternite 7 weakly carinate, ventral margin strongly concave in lateral view . . . . . *R. pseudocelbensis*
- Sternite 7 strongly carinate, ventral margin straight in lateral view . . . . . 12
- 12. Tergite 7 about 1.5 times as long as its basal width . . . . . *R. sulawesiana*
- Tergite 7 about 1.1 times as long as its basal width . . . . . *R. celebensis*

#### *Rhagovelia celebensis* Polhemus & Polhemus

*Rhagovelia celebensis* Polhemus & Polhemus 1988: 199-200, figs. 179-186, 229.

Material. – Sulawesi Selatan, E side Lake Matana, Kg. Salura, 2°32'S 121°28'E, 450m, narrow tributary Lake Matana, 15.X.1993, 1♂; same, 20.X.1993, 4♂ 4♀ apterous, leg. J. P. & M. J. Duffels (ZMAN). Sulawesi Utara, Mt. Ambang nr. Kotamobagu, 20 km E of alt. m 1210, 8.XI.1985, leg. J. Krikken, multistr. evergreen forest, soil litter sifted, 1♀ apt. (RMNH).

***Rhagovelia kastanoparuphe* Nieser & Chen**

*Rhagovelia kastanoparuphe* Nieser & Chen, 1993: 274-275, figs. 30-34, 84.

Nieser & Chen (1993) stated a similarity of *R. kastanoparuphe* and '*R. celebensis* and related forms'. Because of some characters (especially in colour and shape of parameres) which are differing from the other species of the *R. orientalis*-group, this species was provisionally placed in the *R. papuensis*-group, which was regarded polyphyletic. The occurrence of a dealate specimen and most of the distinctive characteristics mentioned in the diagnosis show that *R. kastanoparuphe* can best be placed in the *R. orientalis*-group, although it seems not to be closely related with any other described species in this group.

***Rhagovelia pseudocelebensis* Nieser & Chen**

*Rhagovelia pseudocelebensis* Nieser & Chen 1993: 275, figs. 35-40, 80-81.

Material. – Sulawesi Selatan, Batusitanduk {2°48'S 120°10'E} N of Palopo, narrow river, 2.XI.1993, leg. J. P. & M. J. Duffels, 4♂ 3♀; 15 km W of Palopo, 2°57'10"S 120°07'30"E, gardens and disturbed rain forest, 30.X.1993, leg. J. P. & M. J. Duffels, 1♀ (ZMAN).

***Rhagovelia sulawesiana* Polhemus & Polhemus**

*Rhagovelia sulawesiana* Polhemus & Polhemus 1988: 198-199, figs. 158-164, 230.

Material. – Sulawesi Selatan, SW Celebes, 1100m, Mt. Lompobatang area, Malino {ca 5°15'S 119°48'E}, 2, 8-10.VI.1982, M. A. Lieftinck, 5♂ 2♀ apt., 1♂ 1♀ macr. (RMNH).

Although Polhemus & Polhemus (1988) stated the similarities between *R. sulawesiana* and *R. celebensis*, they decided to class them within different groups without explanation. *Rhagovelia celebensis* was correctly regarded as a species of the *R. orientalis*-group, but *R. sulawesiana* as a species of the *R. papuensis*-group. The classification of apterous specimens of these groups may be difficult using the characters given by Polhemus & Polhemus (1988), but the macropterous specimens studied show clearly that *R.*

*sulawesiana* also belongs to the *R. orientalis*-group. In addition the body shape, the teeth on hind femur, and the lack of spicules on proepisterna and juga are typical for this group. The shape of the paramere of male and the long process of the tergite 7 of female show a close relationship with *R. cylindros* sp.n. and *R. daktylophora*.

***Rhagovelia cylindros* sp. n.**

(figs. 1, 21, 34, 43, 44)

Type material. – Holotype apterous ♀ (ZMAN) INDONESIA: Sulawesi Utara, Pulau Sangihe, Desa Laine, Sungai Laine, 12. Nov. 1994, N9463, leg. N. Nieser (fig. 44). Sungai Laine [different from N9454/56 which is on the other side of the island!], rather large pothole at water fall used for swimming (and picnics on the banks 'proyek wisata = tourist spot'), a lot of *Hydrilla*. *Rhagovelia* at open to moderately open spots. Paratypes (NCTN unless otherwise indicated), same data as holotype, 24♂ 10♀ apterous, 3♂ 5♀ macropterous, distributed as follows: 1♀ apt. (allotype) ZMAN, 1♂ 1♀ apt., 1♂ macr. NHMW, 3♂ 3♀ OXUM. Additional paratypes (adults only) all P. Sangihe and leg. N. Nieser: Desa Simuang (near Malahu), Sungai Simuang, 28.VI.1994, N9457. Mountain stream, water clear, hyaline, boulders, stones, stretches with sand, 1♂ 3♀ apt., 1♀ macr. (RMNH); Desa Utaurano, Sungai Apanukang, 14.XI.1994, N9465. Upstream tributary of S. Laine (N9454 & 56). Mountain stream, bottom boulders, large stones and conglomerate rock, 5-10m wide, depth variable (up to >1m, mostly about 0.3 m), velocity of current variable, 33♂ 32♀ apt., 2♂ macr. (MUDH, SEMC 1♂ 1♀ apt. each); N9465A: Rather large pothole, 40x15m c. 1m deep in mountain stream, virtually stagnant, bottom rock covered with fine silt. Used e.g. for rearing goldfish in cages in the 'pond', 35♂ 15♀ apt., 1♂ 4♀ macr. (2♂ 2♀ apt., 1♂ macr. NHMW, 4♂ 3♀ JTPC, 2♂ 2♀ MBBJ, 2♂ 2♀ USCP).

Description. – Apterous form. Rather small generally dark species. Dimensions. Length ♂ 2.88-3.00, ♀ 3.15-3.40; width (across mesoacetabula) ♂ 1.20-1.30, ♀ 1.32-1.40; width of head ♂ 0.76-0.80, ♀ 0.76-0.80; width of pronotum ♂ 0.98-1.00, ♀ 0.92-1.04.

Colour generally dark grey to black, yellowish transverse band anteriorly on pronotum narrow, reaching to inner margins of eyes, indistinct due to a cover of grey pubescence. Basal third of antennal segment 1, distal part of anterior and posterior acetabula, apical rim of mesoacetabula, anterior and posterior coxae, anterior and part of posterior trochanters and in most specimens variable part proximally of an-

terior femur yellow to light brown. Connexiva entirely grey to black. Pro- and mesopleura except for its dorso-posterior quarter, pruinose, light grey.

Minute black denticles absent. Posterior three quarters of pronotum indistinctly punctured, pleura smooth without recognizable rows of punctures. Vertex, inter oculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body clothed with short pubescence, virtually absent laterally in females, superimposed by longer yellow bristles which are especially strongly developed ventrally in males and caudally in both sexes but much more prominent in females (figs. 21, 34).

Length of antennal segments I : II : III : IV ♂ 0.81 : 0.42 : 0.48 : 0.46, ♀ 0.78 : 0.40 : 0.46 : 0.44. Pronotum long, covering mesonotum, shorter than wide (c. {0.8-0.9}/1.0). Length of metanotum on median line, 0.1. Abdominal tergites 1-4 subequal in length (0.15), remaining tergites in female covered by connexiva, in male tergite 5 subequal, 6 slightly (0.2) and 7 distinctly (0.4) longer. Abdominal sternites 3-5 subequal, about 0.15 long, sternites 2 and 6 slightly longer 0.20, sternite 7 distinctly longer, 0.35 in male. Sternite 2-5 subequal, 0.20; 6 slightly (0.25) and 7 distinctly (0.55) longer in female.

Male. Hind femur slightly incrassate, on average slightly over five times as long as wide (1.34/0.26). Ventral margin slightly distally of halfway with a single larger spine, half as long as the width of femur, followed by a double row of about seven small teeth (fig. 1). Posterior tibia virtually straight, armed beneath with a row of about 15 small teeth which are shorter than and covered by the pilosity of the tibia. Connexiva more or less horizontal to slanting slightly upward (less than  $0.15\pi$ ), gradually converging posteriad. Basal width of abdominal tergite 7 three quarters its median length (0.3/0.4). Tergite 8 basally as wide as long (0.35). Abdominal sternites 5 and 6 flattened with an indication of a keel and pilosity laterally longer than medially, sternite 7 ventrolaterally compressed with a distinct though low and comparatively broad, median keel. Parameres as in fig. 43.

Female. Posterior femur as in male, about five times as long as wide (1.23/0.25). Posterior tibia unarmed except for a small apical spine. Connexiva more or less vertical strongly converging on segments 1-5, nearly meeting over abdomen on segment 6 and anterior part of 7, then diverging to make room for the erect finger-like projection on tergite 7 (fig. 21). Apex of connexiva with a triangular caudal projection, caudal margin accentuated by a dense fringe of large bristles (fig. 34). Tergites 8 and 9 vertical, only visible in caudal view.

Macropterous form. – Essentially as apterous form except for development of hemielytra and thorax. Length ♂ 3.40-3.46, ♀ 3.58-3.62, humeral width of

pronotum ♂ 1.28-1.42, ♀ 1.37-1.41, median length of pronotum ♂ 1.18-1.22, ♀ 1.23-1.28. Pronotum black orange-yellow transverse band at anterior margin reaching to inner margins of eyes, rather indistinct due to cover by whitish pubescence. Propleura with a distinct row of punctures near ventro-posterior margin. Hemielytra reaching 0.4 beyond apex of abdomen, brown with darker veins. A pair of elongate proximal cells not reaching halfway hemielytron, an elongate outer apical cell (near costal margin) reaching to one fourth from apex, central cell absent. Keels on base of abdomen well-developed but short, reaching only to about halfway tergite 2. Connexiva of female vertical, not bent over abdomen.

Etymology. – *Cylindros* (kulindros), Greek noun meaning cylinder, referring to the form of caudal part of abdomen in female.

Comparative notes. – This species is closely related with *R. sulawesiana* and *R. daktylophora*, with which it shares the long process on tergite 7 of females. Females differ from *R. sulawesiana* in the upwardly directed process on tergite 7 (posteriorly directed in *R. sulawesiana*), from *R. daktylophora* in the blunt process of connexiva, which are nearly touching each other (but clearly separated in *R. daktylophora*), and from both in the long black hairs laterally on hind margin of sternite 7. Males differ from all the other species of the group in the hairs on sternites 5 and 6 which are laterally longer than medially.

### The *Rhagovelia sarawakensis*-group

Diagnosis: Small and slender species, length less than 3 mm. Colour black with a short orange brown band on pronotum. Pronotum in apterous specimens shorter than length of an eye, about one third as long as the exposed mesonotum. Fore wing with three or four closed cells slightly reaching distal half. Abdominal carinae of winged specimens extending posteriorly to tergite 3. In dealate specimens fore wing broken in middle, behind closed cells. Tergite 8 of female horizontal.

Distribution: Sri Lanka, Southeast Asia and South China, Ryukyu Islands, Taiwan, Palawan, Borneo, Sumatera, Java, Bali, Nusa Tenggara.

Only one species, *R. samarinensis*, is reported from Sulawesi by the record of a single macropterous female (Polhemus & Polhemus 1988). There are no further records from Sulawesi, and the species group is also not known from other parts of Wallacea including the Philippines (except Palawan). Therefore the authors regard this single record as doubtful.

A single male of *R. sumatrensis* Lundblad, which according to Polhemus (1990) belongs to this group, from Lombok (new record) is deposited in RMNH. As this species was previously recorded from Flores and



Sumbawa (Nieser & Chen 1992) it can probably be found in most of the Nusa Tenggara.

**Check list of species groups and species of *Rhagovelia* Mayr known from the province of Sulawesi.**

*R. papuensis*-group

- abra* sp. n.
- achna* sp. n.
- blogiokommena* Nieser & Chen, 1993
- grayi* Polhemus & Polhemus, 1988
- horaia* Nieser & Chen, 1993
- kalami* Nieser & Chen, 1993
- krama* sp. n.
- lorelinduana* Polhemus & Polhemus, 1988
- minahasa* Polhemus & Polhemus, 1988
- ochra* sp. n.
- pruinosa* Polhemus & Polhemus, 1988
- robina* Nieser & Chen, 1993
- skoura* sp. n.
- tsouloufi* sp. n.
- trichota* Nieser & Chen, 1988
- tropidata* Nieser & Chen, 1993
- unica* Polhemus & Polhemus, 1988
- wallacei* Polhemus & Polhemus, 1988

*R. gyrsta*-group

- gyrista* sp. n.
- hamdjadi* Polhemus & Polhemus, 1988

*R. plichona*-group

- chrysomalla* Nieser & Chen, 1993
- plichona* sp. n.

*R. orientalis*-group

- celebensis* Polhemus & Polhemus, 1988
- cylindros* sp. n.
- daktrylophora* Nieser & Chen, 1993
- kastanoparuphe* Nieser & Chen, 1993
- pseudocolebensis* Nieser & Chen, 1993
- sulawesiana* Polhemus & Polhemus, 1988

*R. sarawakensis*-group

- ? *samarinda* Polhemus & Polhemus, 1988

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## SEVEN NEW SPECIES OF *HYDROTREPES* CHINA (HELOTREPHIDAE: HETEROPTERA) FROM SULAWESI

Polhemus, J. T., 1997. Seven new species of the genus *Hydrotrepes* China from Sulawesi. Tijdschrift voor Entomologie 140: 43-54, figs. 1-55 [ISSN 0040-7496]. Published 31 October 1997.

A definite locality in Sulawesi is established for *Hydrotrepes bouvieri* (Kirkaldy). The following new species are described; *Hydrotrepes celebensis* Polhemus sp. n., *H. kamarora* Polhemus sp. n., *H. marana* Polhemus sp. n., *H. nieseri* Polhemus sp. n., *H. taweli* Polhemus sp. n., *H. variegatus* Polhemus sp. n., and *H. viriosus* Polhemus sp. n. Some morphological features of Helotrephidae are discussed.

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Key words. – Indonesia; Sulawesi; Helotrephidae; *Hydrotrepes*; new species.

The following descriptions of new taxa and notes on *Hydrotrepes bouvieri* (Kirkaldy) are needed for a forthcoming publication on the Nepomorpha of Sulawesi by Nieser and Chen. These descriptions have been prepared for some time, intended to be part of a comprehensive revision of the genus *Hydrotrepes*, however the above intended publication by Nieser and Chen and a revision of the Helotrephidae of the Philippines intended by Herbert Zettel have persuaded me to instead deal with the genus on a regional basis. The material described here was mostly collected by D. A. Polhemus and myself during a 1985 expedition to the Malay Archipelago and Southeast Asia supported by the National Geographic Society. We have collected many species (mostly undescribed) of *Hydrotrepes* on Leyte, Luzon, Mindanao, Mindoro, and Palawan in the Philippines; Bali, Java, Sulawesi, north and south Sumatra, Sumba, and Timor in Indonesia; East Malaysia (Sabah) and West Malaysia. Additional species of the genus were collected by M. Satô on Bohol and Cebu in the Philippines, and by Taylor and Messer on Morotai, North Moluccas. Zettel (in litt.) possesses other species from Thailand, Laos, East Malaysia (Sarawak), and Indonesia (Nias). Thus the genus *Hydrotrepes*, with only six previously described species from Luzon, Sri Lanka, Sulawesi and Sumatra (all represented in the J. T. Polhemus Collection), is actually speciose and widespread; the general distribution, by region, was given by Polhemus & Polhemus (1990), along with a pattern of endemism exhibited by *Rhagovelia* (Veliidae) and *Ptilomera* (Gerridae) that is similar to some *Hydrotrepes* species on Sulawesi.

The last systematic reviews of the major classifica-

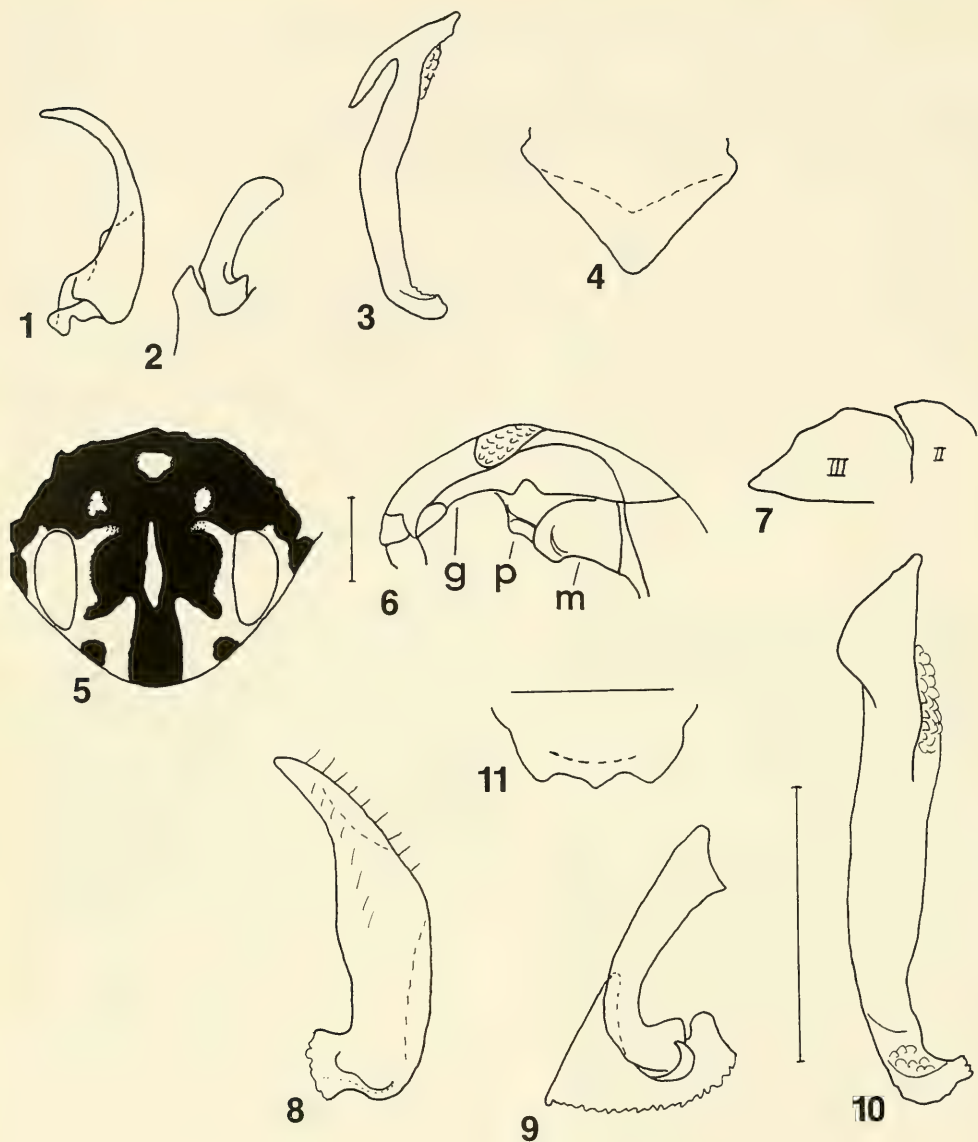
tion of Helotrephidae were given by Esaki and China (1927, 1928) and China (1935), however Papáček, Stys and Tonner (1988) have provided an extensive review and morphological analysis in connection with the description of a new subfamily. The genus *Hydrotrepes* (type species, *Helotrephes bouvieri* Kirkaldy) was established by China (1935), after previously being carefully described by Esaki and China (1928, as *Helotrephes*) based on syntypes of *bouvieri*. Various authors have dealt with other genera of Helotrephidae and described new subfamilies, tribes, genera and species, but no new species of *Hydrotrepes* have been described for 66 years.

All measurements are given in millimeters. The holotypes and some paratypes will be placed in the Smithsonian Institution (USNM); all other specimens are in the Polhemus collection (JTPC), except some duplicate material that will be distributed to at least the Nieser Collection (NCTN), American Museum of Natural History (AMNH), Naturhistorisches Museum Wien (NHMW) and the Museum Zoologicum Bogoriense (MBBJ).

### SPECIES DISCRIMINATION

A number of characters were evaluated as potentially useful in discriminating species of the genus *Hydrotrepes*, some previously used by other authors. The morphological nomenclature follows Esaki and China (1928) and Papáček, Stys and Tonner (1988) unless otherwise noted. I have concluded that that species discrimination should primarily rely on the morphology of the male genitalia, and to a lesser degree





Figs. 1-4. *Hydrotrepes bouvieri* Kirkaldy. – 1, Male ventral paramere; 2, Male dorsal paramere; 3, Aedeagus; 4, Female abdominal sternite VII. Internal phragma indicated by dashed line.

Figs. 5-11. *Hydrotrepes celebensis* sp. n. – 5, Cephalonotum, anterior view; 6, Pronotal and genal plates, meso- and proepisterna. g - pronotal and genal plates, m - mesoepisternum, p - proepisternum; 7, Ventral abdominal carinae II, III; 8, Male ventral paramere; 9, Male dorsal paramere; 10, Aedeagus; 11, Female abdominal sternite VII. All scale bars = 0.5 mm.

the female abdominal sternite VII and pattern of dark markings on the cephalonotum; all other characters are variable and must be used in conjunction with the former, with caution. For this reason a key has not been provided, but figures are presented instead to aid in the separation of species.

Lateral pronotal and genal plates: These structures are well developed in all *Helotrephini* (Esaki & China 1928, fig. 1a) but lacking in all *Limnotrephini*. The shape, particularly of the distinct 'notch' below the eye, is variable, and although sometimes helpful, should usually not be considered as diagnostic by itself.

Overall body size: The overall size is useful in separating species, and seems remarkably constant for individual populations of each species, except for the specimens of the sympatric variety of *H. nieseri* from northern Sulawesi which are much smaller than the nominate form (see discussion below). The macropterous form (with a claval suture) is usually darker and dorsoventrally larger than the brachypterous form (without a claval suture; hemelytra brachypterous, hindwings micropterous), and these two morphs may appear to be different species at first glance.

Male terminalia and genitalia: The morphological details of the complex terminal abdominal segments and genitalia of *Hydrotrepes* males are the most reliable characters for species separation. This includes the ventral laterotergites of segments VII and VIII, the posterior margin of abdominal segment IX, the parameres, and the aedeagus.

Mesopleural and propleural plates: The shapes of these plates are sometimes useful in discriminating between closely related sympatric species.

Ventral abdominal carinae: This character was used by Esaki and China (1927, 1928) and China (1935), but has proved to be variable and generally unreliable except for gross features. A few species have extreme modifications which can be diagnostic.

Prosternal carina: The prosternal carina is variable, but sometimes helpful when extreme differences are evident between species.

Female abdominal sternite VII. This structure, often called the subgenital plate, is sometimes diagnostic and often helpful, but the differences between species are often subtle, and closely related species may exhibit a similar shape.

Color pattern: The pattern of dark markings on the cephalonotum, in particular on the frons, are helpful in discriminating between closely related species. While the pattern may vary considerably in a given population, it varies in a predictable way, with certain 'markers' constant (analogous to the widely used hemelytral 'eunomy' in the family Saldidae). The maculations of the hemelytra are also sometimes useful in separating sympatric species.

Stridulatory mechanisms: All species of the genus

*Hydrotrepes* possess a stridulatory mechanism, as described by Polhemus (1990). These appear to be monotonous and not species diagnostic. It is conceivable that an examination by SEM would reveal diagnostic fine structure not visible at 80 ×.

### *Hydrotrepes bouvieri* (Kirkaldy) (figs. 1-4)

*Helotrephes bouvieri* Kirkaldy 1904: 129. Syntypes 4 males, 2 of unknown sex, Celebes, de la Savinière, National Museum of Natural History, Paris [not examined]; Esaki and China 1927: 281; Esaki and China 1928: 143 (re-description, figures); Lundblad 1933: 114.

*Hydrotrepes bouvieri* – China 1935: 594 (new genus, key); Miyamoto 1952: 2; Poisson 1960: 333; Polhemus 1990: 60 (world checklist).

Material examined. – 46 brachypterous adults, 3 nymphs, Sulawesi Utara, Kab. Bolaang Mongondow, Lake Mala (Moat), E of Kotamobagu, 0°44' N, 124°27' E, 1000 m el., CL 2113, 10 Sept. 1985, J. T. & D. A. Polhemus (JTPC, NCTN, USNM, MBBJ, NHMW).

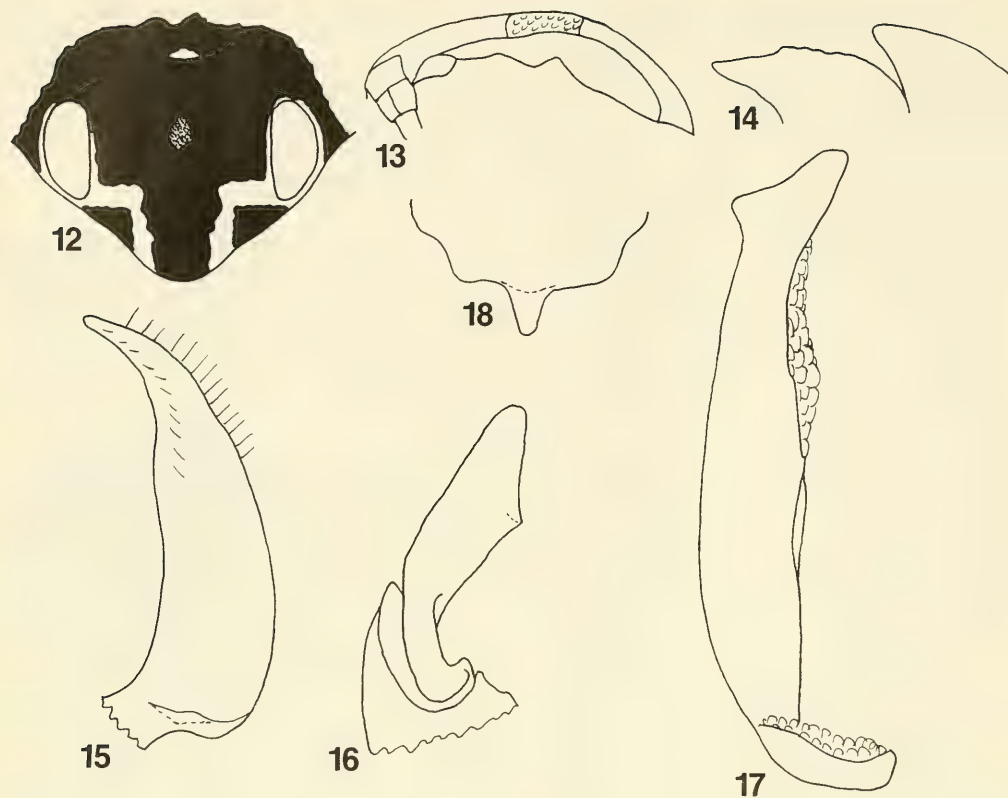
Discussion. – The males at hand match in every detail the exhaustive description given by Esaki & China (1928). The male aedeagus and parameres are shown in figs. 1-3. Because the female of this species was not previously known, sternite VII is figured here (fig. 4). No definite locality was previously established for this species, as the labels on the syntypes simply gave 'Celebes'. The habitat of *Hydrotrepes bouvieri* is unusual for the genus, as it was collected in a lake rather than a stream. The habitat of *bouvieri* was in tangled root masses, along the wave undercut edges of isolated emergent clumps of reeds that formed 'pedestals' in shallow water along the lake shore. *Hydrotrepes corporaali* China has been collected in both lakes and streams (Lundblad 1933; Polhemus unpubl.), so it is likely that *H. bouvieri* also inhabits streams.

### *Hydrotrepes celebensis* Polhemus sp. n. (figs. 5-11)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Selatan Prov., Marana River, nr. Camba, 50 km E of Maros, CL 2167, 450 m el., 14 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes, 7 brachypterous adults, 8 macropterous adults, same data as holotype (JTPC, NCTN, USNM, MBBJ).

Size. – Brachypterous form: length 2.40 - 2.42 mm, width across base of cephalonotum 2.02 - 2.08 mm.

Colour. – Brachypterous form: ground color yellowish, heavily marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 5); pronotum with irregular transverse light band across



Figs. 12-18. *Hydrotrepes kamarora* sp. n. —12, Cephalonotum, anterior view; 13, Pronotal and genal plates; 14, Ventral abdominal carinae II, III; 15, Male ventral paramere; 16, Male dorsal paramere; 17, Aedeagus; 18, Female abdominal sternite VII.

middle. Base of scutellum with a transverse deep brown stripe. Hemelytra, scutellum with strong pattern of deep brown irregular, randomly scattered markings covering about half of dorsum. Venter brown. Legs, antennae yellowish, legs darker basally, rostrum brown.

Structure. — Brachypterous form: cephalonotum shining, convex, set with small alveoli, in dorsal view (of entire insect) broader than long (2.08: 1.26), lateral margins carinate behind eyes. Mesopleural and propleural plates notched (fig. 6). Eye length/width, 0.54/0.29. Interocular distance 0.86. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.18: 0.43.

Scutellum shining, finely rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying

structure or pigmentation visible through translucent cuticle; length: width; 1.15: 1.15.

Hemelytra opaque, faintly rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudo-membrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 7.

All femora with pectinate bristles beneath, longer basally. Claws of each leg about half as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; aedeagus and parameres as shown in figs. 8-10. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 11.

Macropterous form: similar in size, color and structure to brachypterous form, except for presence of claval suture and well developed hind wings.



Discussion. — *Hydrotrepes celebensis* sp. n. is so far known from a single population. The body size of both sexes and wing morphs is unusually uniform. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

Etymology. — The name *celebensis* refers to the island of origin.

*Hydrotrepes kamarora* Polhemus sp. n.  
(figs. 12-18)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Tengah Prov., stream 10 km SE of Kamarora, Lore Lindu National Park, CL 2156, 950 m el., 8 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 4 brachypterous adults, 6 macropterous adults, 8 nymphs, same data as holotype (JTPC, NCTN, USNM); 2 macropterous males, 1 macropterous female, Sulawesi Tengah Prov., stream 9 km E of Taweli, CL 2160, 150 m el., 10 Oct. 1985, J. T. & D. A. Polhemus; 1 brachypterous male, 2 brachypterous females, 1 nymph, Sulawesi Utara Prov., forest stream S of Lake Mala, CL 2118, 1200 m el., 11 Sept. 1985, J. T. & D. A. Polhemus (JTPC).

Size. — Brachypterous form: length 2.88 - 3.42 mm, width across base of cephalonotum 1.94 - 2.38 mm.

Colour. — Brachypterous form: ground color yellowish, heavily marked with brown. Cephalonotum often completely dark anterior to suture, except along eyes and a small median light streak; lighter colored specimens with a more complex pattern of deep brown markings (fig. 12); pronotum with irregular transverse light band across middle. Scutellum basally dark, lighter posteriorly, with several yellowish areas medially. Hemelytra dark on basal fourth, lighter posteriorly, with scattered lighter regions; some specimens almost completely dark. Venter yellowish brown. Legs, antennae yellowish, rostrum brown.

Structure. — Brachypterous form: cephalonotum shining, convex, set with alveoli, in dorsal view (of entire insect) broader than long (2.34 : 1.44), lateral margins carinate behind eyes. Mesopleural and propleural plates shallowly notched (fig. 13). Eye length/width, 0.58/0.29. Interocular distance 1.19. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.22 : 0.54.

Scutellum shining, not rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.48: 1.33.

Hemelytra opaque, shining, set with alveoli each

bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 14.

All femora with pectinate bristles beneath, longer basally, densest on anterior femora, sparsest on posterior femora. Claws of each leg about one-third as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; aedeagus and parameres as shown in figs. 15-17. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 18.

Macropterous form: similar in size, color and structure to brachypterous form, except for presence of claval suture and well developed hind wings.

Discussion. — *Hydrotrepes kamarora* sp. n. is so far known from three populations. The body size of both sexes and wing morphs is quite uniform within each population, but varies considerably between populations. Elevation does not seem to be correlated with size, as the largest specimens are from the type locality at 950 m, the smallest from near Lake Mala at 1200 m, and the intermediates from east of Taweli at 150 m. In all specimens the scutellum is shining and not rugulose. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

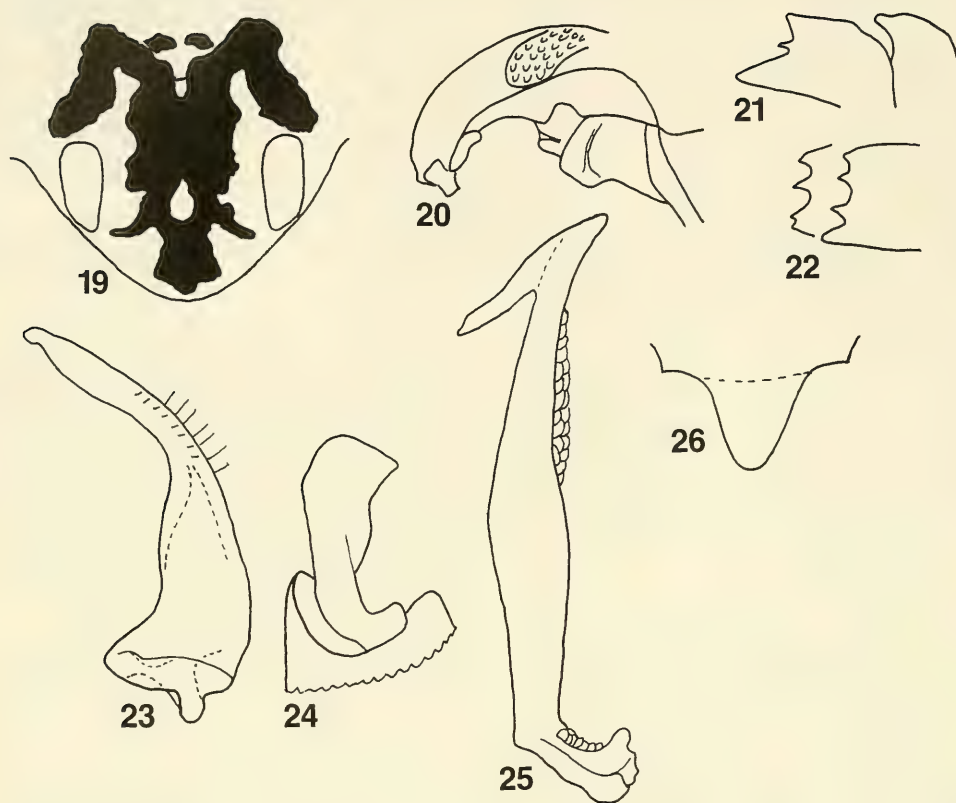
Etymology. — The name *kamarora* is a noun in apposition, referring to the village nearest the type locality.

*Hydrotrepes marana* Polhemus sp. n.  
(figs. 19-26)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Selatan Prov., Sungai Pattanuang at Biscang Labboro Recreation Area, 7 km SW of Bantimuring, CL 2165, 0-100 m el., 13 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 7 brachypterous males, 1 brachypterous female, 9 nymphs, same data as holotype (JTPC, NCTN); 2 brachypterous males, 1 brachypterous female, Sulawesi Selatan Prov., Marana River nr. Laiya, CL 2167, 0-100 m el., 14 Oct. 1985, J. T. & D. A. Polhemus (JTPC).

Size. — Brachypterous form: length 2.99 - 3.09 mm, width across base of cephalonotum 2.09 - 2.16 mm.

Colour. — Brachypterous form: ground color yellowish brown to fuscous, moderately marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 19); pronotum largely yellowish brown, with rather regularly spaced maculations. Base of scutellum with a broad transverse brown stripe. Hemelytra, scutellum with numerous small deep



Figs. 19-26. *Hydrotrepes marana* sp. n. —19, Cephalonotum, anterior view; 20, Pronotal and genal plates, meso- and proepisterna; 21, Ventral abdominal carinae II, III, CL 2167; 22, Ventral abdominal carina III, CL 2165; right, male; left, female; 23, Male ventral paramere; 24, Male dorsal paramere; 25, Aedeagus; 26, Female abdominal sternite VII.

brown irregular, randomly scattered markings, not dense, often anastomosing. Venter brown. Legs, antennae yellowish, rostrum yellowish to brown.

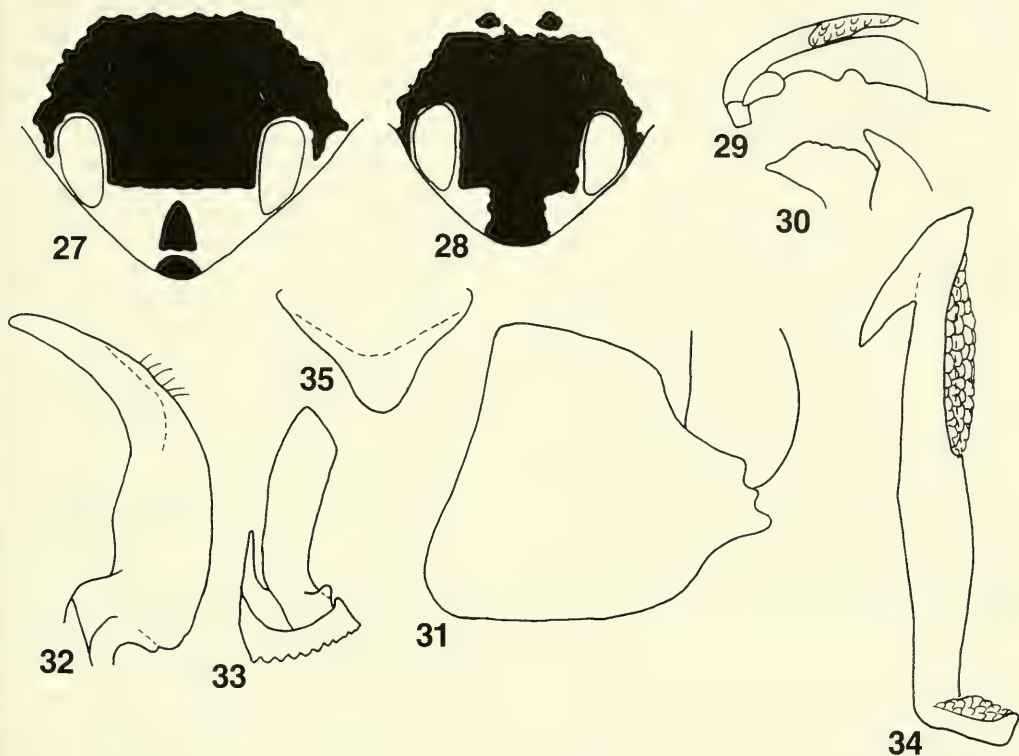
Structure. — Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.12 : 1.37), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 20). Eye length/width, 0.58/0.29. Interocular distance 1.01. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.25 : 0.54.

Scutellum faintly shining, finely rugulose, set with

tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.30: 1.33.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in figs. 21-22.

Fore and middle femora with pectinate bristles be-



Figs. 27-35. *Hydrotrepes nieseri* sp. n. – 27, Cephalonotum, anterior view, typical variety; 28, Cephalonotum, anterior view, variety *minutus*; 29, Pronotal and genal plates; 30, Ventral abdominal carinae II, III; 31, Male abdominal segment IX, ventral view; 32, Male ventral paramere; 33, Male dorsal paramere; 34, Aedeagus; 35, Female abdominal sternite VII.

neath, longer basally; hind femora mostly bare. Claws of each leg about one-third to half (on posterior) as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; aedeagus and parameres as shown in figs. 23-25. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 26.

Macropterous form: unknown.

Discussion. – *H. marana* is so far known only from a limited area of Sulawesi Selatan Province. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

Etymology. – The name *marana* is a noun in apposition, referring to the river where part of the type series was collected.

*Hydrotrepes nieseri* Polhemus sp. n.  
(figs. 27-35)

Type material. – Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Utara Prov., tributary to Tumpah River, 0° 35' N, 123° 54' E, 62 km SW of Kotamobagu, CL 2101, ~235 m el. 4 Sept. 1985, J. T.



& D. A. Polhemus (USNM). Paratypes (all collected by J. T. & D. A. Polhemus; nymphs not paratypes), Indonesia, Celebes, Sulawesi Utara Prov.: 144 brachypterous adults, 14 macropterous adults, 17 nymphs, same data as holotype (JTPC, NCTN, AMNH, USNM, MBBJ, NHMW); 54 brachypterous adults, 4 macropterous adults, 15 nymphs, Tumpah River, 0° 35' N, 123° 54' E, 60 km SW of Kotamobagu, CL 2100, 211 m el., 3 Sept. 1985; 2 macropterous females, stream, trib. of Sungai Ongaak Mongondow, 4 km S of Inobonto, CL 2106, 6 Sept. 1985; 24 brachypterous adults, 13 macropterous adults, 2 nymphs, upper Sungai Metelanga and tributary, 10 km S of Dolodua, CL 2108, 7 Sept. 1985; 6 brachypterous males, 2 brachypterous females, warm stream, 8 km S of Dolodua on Malibagu rd., CL 2110, 7 Sept. 1985; 27 brachypterous adults, 1 macropterous female, 3 nymphs, Sungai Metelanga, 5 km S of Dolodua, CL 2111, 7 Sept. 1985; 13 brachypterous adults, 1 nymph, cave spring and stream at Komangaan, NW of Kotamobagu, CL 2120, 14 Sept. 1985; 4 brachypterous males, 2 brachypterous females, 1 macropterous female, Pononontuna River at Tapakulintang, 200 m el., CL 2121, 15 Sept. 1985; 14 brachypterous adults, 2 macropterous females, Tondano river tributary, S of Airmididi, CL 2127, 20 Sept. 1985; 1 macropterous male, stream W of Danowudu, E of Manado, CL 2129, 20 Sept. 1985 (JTPC).

Size. — Brachypterous form: length 2.38 - 2.95 mm, width across base of cephalonotum 1.66 - 2.02 mm.

Colour. — Brachypterous form: ground color yellowish brown to fuscous, extensively marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 27, 28); pronotum largely yellowish brown, broadly embrowned anteriorly along suture, narrowly dark posteriorly, with a few median maculations in a broad sordid yellowish transverse band. Base of scutellum with a broad transverse brown stripe. Hemelytra, scutellum with numerous large brown irregular, randomly scattered markings, not well defined, often anastomosing, more numerous basally. Venter brown. Legs, antennae yellowish, rostrum brown.

Structure. — Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.02 : 1.08), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 29). Eye length/width, 0.50/0.27. Interocular distance 0.97. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.22 : 0.43.

Scutellum faintly shining, finely rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in

some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.30 : 1.22.

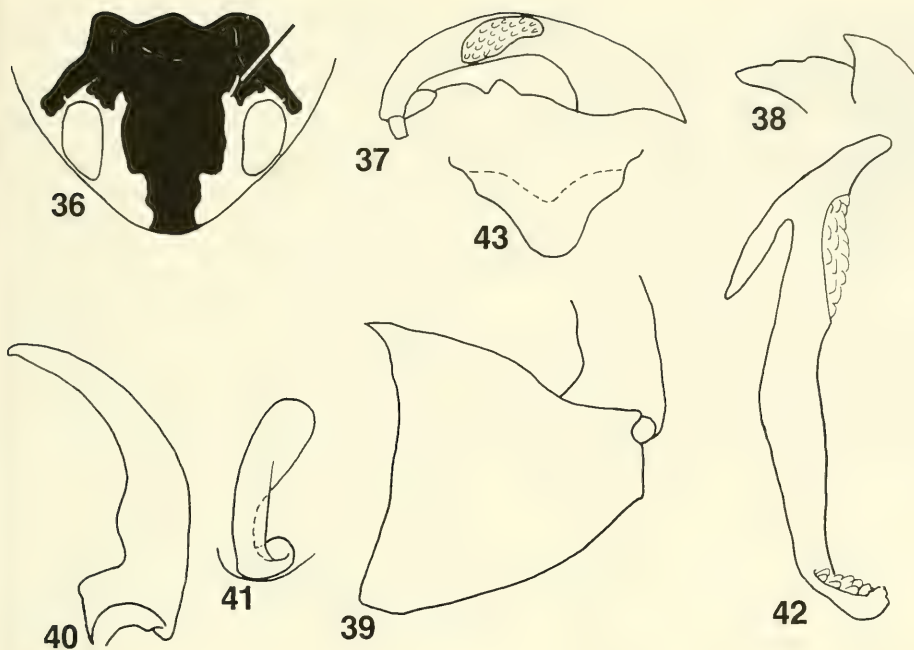
Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 30.

All femora with pectinate bristles beneath, longer basally; on hind femora sparse, shorter. Claws of each leg about one-third as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; ventral view of segment IX shown in fig. 31; aedeagus and parameres as shown in figs. 32-34. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 35.

Macropterous form: similar in size and structure to brachypterous form, except for presence of claval suture and well developed hind wings, and color usually darker.

Discussion. — *Hydrotrepes nieseri* sp. n. has two distinct varieties, easily separable in most samples on the basis of size and coloration of the frons, that were initially considered to be separate species. The male and female terminalia and all other characters are the same, however, so that these forms can be considered only as varieties, not distinct species-group taxa. The larger specimens with a distinctly separated dark spot on the lower frons (fig. 27) are the typical variety, and the smaller forms with the frons completely dark or with a continuous dark vertical marking on the frons (fig. 28) are given the varietal name *Hydrotrepes nieseri* var. *minutus*. In a sample from CL 2108 these two varieties intergrade and exhibit the complete range of coloration and size, but in most populations the two varieties are easily separable.

*H. nieseri* may be separated from its congeners by the male genitalia (e. g. posterior margin of abdominal segment IX straight, details of the parameres, shape of the 'bird head' of the aedeagus), and from most species by the shape of female sternite VII. The latter, however, is similar in females of *H. taweli*, which also have a similar body coloration: females of these species may be separated by the coloration of the frons. In *H. nieseri* the frons is almost always completely dark between the eyes, almost to the lower eye level (figs. 27, 28), without light areas mesad of the postero-mesal eye margin, but rarely with a small light region mesad of the antero-mesal eye margin; in *H. taweli* there is almost always a light region next to each inner eye margin (fig. 36), rarely with the mesal dark region reaching the inner eye margins, but always with a light area (fig. 36, arrow) mesad of each postero-mesal eye margin.



Figures 36-43. *Hydrotrepes taweli* sp. n. – 36, Cephalonotum, anterior view; consistently light region, arrow; 37, Pronotal and genal plates; 38, Ventral abdominal carinae II, III; 39, Male abdominal segment IX, ventral view; 40, Male ventral paramere; 41, Male dorsal paramere; 42, Aedeagus; 43, Female abdominal sternite VII.

**Etymology.** – The name *nieseri* honours Dr. Nico Nieser in recognition of his many contributions to the study of aquatic Heteroptera.

*Hydrotrepes taweli* Polhemus sp. n.  
(figs. 36-43)

**Type material:** Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Tengah Prov., stream 9 km E. of Taweli, NE of Palu, CL 2160, 150 m el., 10 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 78 brachypterous adults, 75 macropterous adults, 10 nymphs, same data as holotype (JTPC, NCTN, AMNH, USNM, MBBJ, NHMW); 18 brachypterous adults, 1 macropterous male, Sulawesi Utara Prov., Tondano River tributary, S of Airmididi, CL 2127, 20 Sept. 1985, J. T. & D. A. Polhemus (JTPC); 5 brachypterous males, 3 brachypterous females, 38 macropterous males, 35 macropterous females, 24 nymphs, Sulawesi Utara Prov., Gunung Klabat, Sg. Giriam, N9452, 23 June 1994, Nico Nieser (JTPC, NCTN).

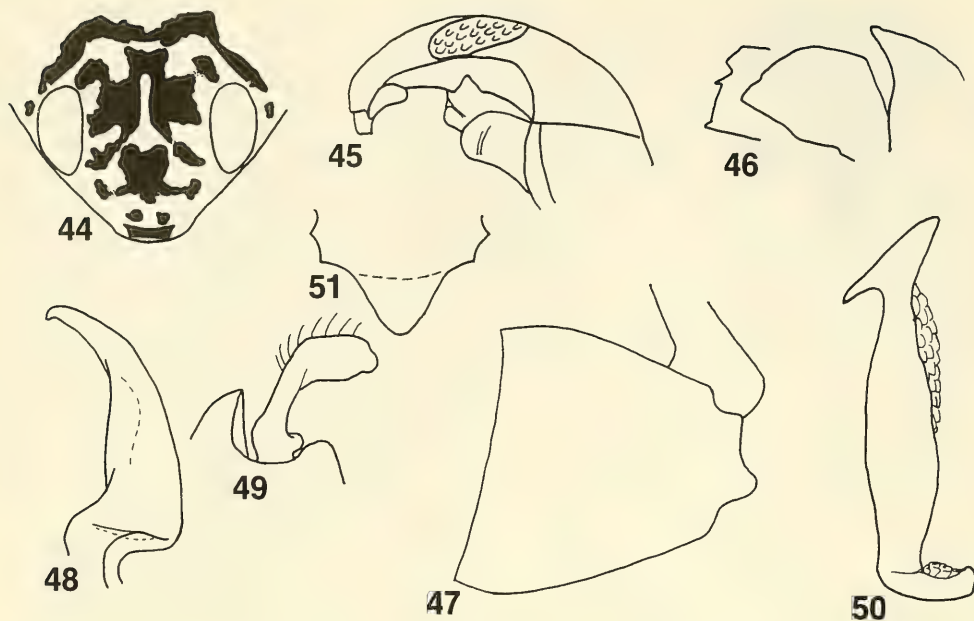
**Size.** – Brachypterous form: length 2.52 - 2.74 mm,

width across base of cephalonotum 1.84 - 1.91 mm.

**Colour.** – Brachypterous form: ground color yellowish brown, heavily marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 36), variable, but always with a light area (arrow) mesad of each postero-mesal eye margin; pronotum with broad irregular transverse light band across middle. Scutellum with a basal transverse brown stripe; basal and medial markings often coalescing to form a large irregular triangle extending posteriorly beyond middle, plus additional dark markings. Hemelytra extensively marked with large brown irregular markings, denser basally, often anastomosing, covering more than half of hemelytral area. Venter brown. Legs, antennae yellowish, rostrum brown.

**Structure.** – Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (1.84 : 1.15), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 37). Eye length/width, 0.50/0.25. Interocular distance 0.83. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.14 : 0.47.

Scutellum shining, finely rugulose, set with tiny



Figs. 44-51. *Hydrotrepes variegatus* sp. n. – 44, Cephalonotum, anterior view; 45, Pronotal and genal plates; 46, Ventral abdominal carinae II, III; male right; III, female, left; 47, Male abdominal segment IX, ventral view; 48, Male ventral paramere; 49, Male dorsal paramere; 50, Aedeagus; 51, Female abdominal sternite VII.

alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.01: 0.97.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 38.

Fore and middle femora with pectinate bristles beneath, longer basally; on hind femora only on basal half. Claws of each leg about one-half to one-third (on posterior) as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; ventral view of segment IX shown in fig. 39; aedeagus and parameres as shown in figs. 40-42. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 43.

Macropterous form: similar in size, color and structure to brachypterous form, except for presence of claval suture and well developed hind wings.

Discussion. – *H. taweli* may be separated from its

congenors by the morphology of the male and female abdominal terminalia, and the coloration of the frons. It is closest to *H. nieseri*, and the female sternite VII of the two species are similar, but they may be separated by the differently formed dark pattern of the frons; see discussion under *H. nieseri*.

Etymology. – The name *taweli* is a noun in apposition, referring to the village nearest the type locality.

*Hydrotrepes variegatus* Polhemus sp. n.  
(figs. 44-51)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Selatan Prov., Sungai Pattanuang at Biseang Labboro Recreation Area, 7 km SW of Bantimuring, CL 2165, 0-100 m el., 13 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 33 brachypterous adults, 20 nymphs, same data as holotype (JTPC, NCTN, AMNH, USNM, MBBJ, NHMW); 1 brachypterous male, 2 brachypterous females, Sulawesi Selatan Prov., Marana River nr. Laiya, CL 2167, 0-100 m el., 14 Oct. 1985, J. T. & D. A. Polhemus (JTPC).



Size. — Brachypterous form: length 2.52 - 2.63 mm, width across base of cephalonotum 1.66 - 1.87 mm.

Colour. — Brachypterous form: ground color yellowish brown to fuscous, moderately marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 44); pronotum largely yellowish brown, with rather regularly spaced maculations. Base of scutellum with a transverse brown stripe. Hemelytra, scutellum with numerous small deep brown maculations, often oval, rather regularly distributed, often anastomosing. Venter brown. Legs, antennae yellowish, rostrum yellowish to brown.

Structure. — Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.12 : 1.37), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 45). Eye length/width, 0.58/0.29. Interocular distance 1.01. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.25 : 0.54.

Scutellum faintly shining, finely rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.30: 1.33.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous

strips. Ventral carinae of abdominal segments II, III as in fig. 46.

All femora with pectinate bristles beneath, longer basally; hind femora with fewest. Claws of each leg about one-half as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; ventral view of segment IX shown in fig. 47; aedeagus and parameres as shown in figs. 48-50. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 51.

Macropterous form: unknown.

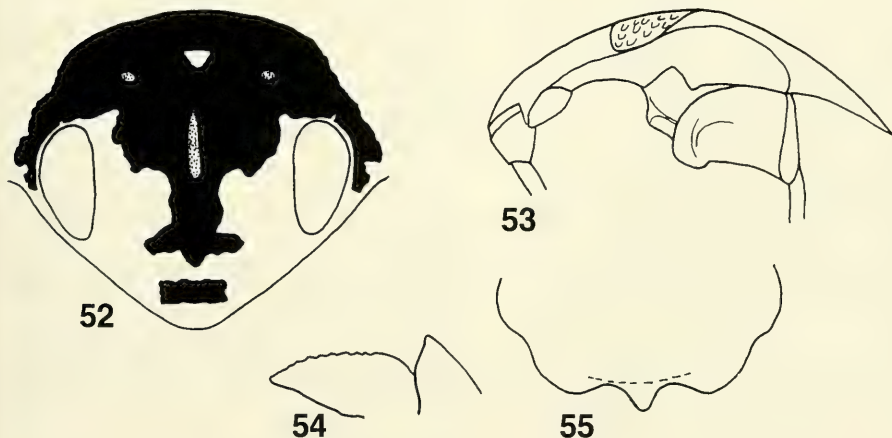
Discussion. — The dorsal dark markings of *H. variegatus* are much more regularly spaced than in other species from Sulawesi, and are often absent from the hemelytra near the base of the scutellum. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

Etymology. — The name *variegatus* refers to the dorsal color pattern of this insect.

*Hydrotrepes viriosus* Polhemus sp. n.  
(figs. 52-55)

Type material: Holotype, macropterous female: Indonesia, Celebes, Sulawesi Tengah Prov., stream 10 km SE of Kamarora, Lore Lindu National Park, CL 2156, 950 m el., 8 Oct. 1985, J. T. & D. A. Polhemus (JTPC; to be placed in the USNM when more material is available).

Figs. 52-55. *Hydrotrepes viriosus* sp. n. — 52, Cephalonotum, anterior view; 53, Pronotal and genal plates; 54, Ventral abdominal carinae II, III; 55, Female abdominal sternite VII.



Size. — Macropterous female: length 3.09 mm, width across base of cephalonotum 2.82 mm.

Colour. — Macropterous female: ground color yellowish brown to fuscous, heavily marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 52); pronotum largely fuscous, with rather regularly spaced maculations covering all but a few small irregular yellowish areas near suture. Scutellum with a broad basal transverse brown stripe; heavily marked with deep brown anastomosed markings, similar to those on pronotum. Hemelytra with numerous small brown circular markings; almost all of these encompass one alveolus, and most alveoli are pigmented, but the markings rarely anastomose. Venter brown. Legs, antennae yellowish, rostrum yellowish to brown.

Structure. — Macropterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.82: 1.44), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 53). Eye length/width, 0.72/0.47. Interocular distance 1.22. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.29: 0.58.

Scutellum shining, not rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.73: 1.73.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings well developed, reaching tips of hemelytra. Ventral carinae of abdominal segments II, III as in fig. 54.

Fore and middle femora with pectinate bristles beneath, longer basally; hind femora mostly bare. Claws of each leg about one-third as long as distal tarsal segment. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 55.

Brachypterous form: unknown.

Discussion. — It is with some reservations that a single female is proposed as a new species, however I am unable to place this specimen in any of the other species before me. It is almost twice as large as *H. celebensis*, which seems to be its closest congener. The female sternite VII is different than any other, and while the shape is superficially similar to *H. celebensis*, the internal phragma is in a different location; the mesopleural and propleural plates have a slightly different shape; and the pattern of dark markings on the cephalonotum and the hemelytra do not match any other species.

The single specimen is macropterous, suggesting

that a more robust population exists somewhere in the vicinity, and the specimen is a 'stray.'

Etymology. — The name *viriosus*, L., robust, strong, refers to the appearance of this insect.

#### ACKNOWLEDGEMENTS

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# *STIGMELLA DIVINA* SP. N., A REMARKABLE SPECIES FROM TURKMENISTAN AND TURKEY (LEPIDOPTERA, NEPTICULIDAE)

Puplesis, R., A. Diškus & E.J. van Nieukerken, 1997. *Stigmella divina* sp. n., A remarkable species from Turkmenistan and Turkey (Lepidoptera, Nepticulidae). – Tijdschrift voor Entomologie 140: 55-58, figs. 1-11 (ISSN 0040-7496). Published 31 October 1997.

*Stigmella divina* sp. n. is described from the Kopet Dag mountains in Turkmenistan and Central Anatolia (Turkey). The species cannot be placed in any known species group, because of its remarkable genitalia. The male possesses a unique androconial patch on the forewing underside.

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Key words. – Nepticulidae; Palearctic; Central Asia; *Stigmella*.

The Nepticulidae of Turkmenistan were recently revised, together with those from other parts of Central Asia (Puplesis 1994). Since then a few more species have been described, and a checklist was published (Puplesis & Diškus 1995, 1996a, 1996b, 1996c, Puplesis et al 1996). Some of the species collected by the first two authors during the 1993 expedition to the Kopet Dag ridge remain to be described. One of these is a peculiar species of *Stigmella*, which does not fit in any of the recognised species-groups. The same species was encountered by the third author amongst unidentified material from Turkey. The nepticulid fauna of Turkey is still imperfectly known, there is as yet no general review available, but a few species were mentioned in several taxonomic papers (Klimesch 1978, van Nieukerken 1985, 1990, van Nieukerken & Puplesis 1991).

We describe this species here to point to its unique set of characters, not fitting into any known species group, awaiting further revisionary work on western Palearctic *Stigmella*.

Type material is deposited in the collection of the Department of Zoology of Vilnius Pedagogical University, Lithuania (VPU), the National Museum of Natural History, Leiden (RMNH) and the Zoological Museum, Copenhagen (ZMUC). Terminology of external features and genitalia follows van Nieukerken

et al. (1990) and Puplesis (1994). Genitalia structures of the Turkmenian specimens were examined and figured in glycerine.

*Stigmella divina* sp. n.  
(figs. 1-11)

Type material. – Holotype ♂: Turkmenistan, western Kopet Dag, 40 km E Kara Kala (= Garrygala), 800 m, 7.viii.1993, leg. R. Puplesis & A. Diškus (VPU). Paratypes: 9♂, 15♀ same data as holotype, 25.vi-18.viii.1993 (VPU, RMNH); 1 ♂ Turkey, Sivas, 10 km W Gürün, 1650 m, 27.vii.1989, leg. Fibiger & Esser, Genitalia slide EJVN 3180 (ZMUC).

Diagnosis. – Females can be recognised by the combination of a yellowish cream thorax and forewing base and the wide fascia. Males, which have a dark thorax, can easily be recognised by the elongate yellow androconial patch on the forewing underside. The male genitalia are characterised by the shape of the valva with the bifid apex and the dagger shaped juxta.

## Description

Male (fig. 1). – Forewing length 2.3-2.7 mm. Head: frontal tuft from ferruginous to brown, occasionally fuscous; scape and collar cream; antenna cream-grey to grey-brown, with 30-31 segments.



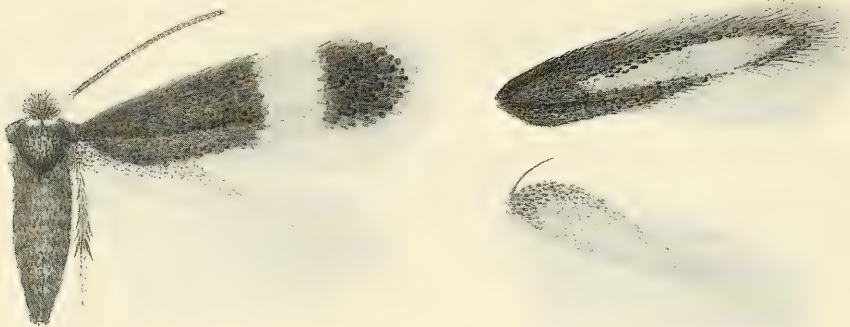


Fig. 1. *Stigmella divina*, male Paratype, Turkey. Left: dorsal view; right: underside of left wings, showing androconial patch. Painted by Roland Johansson.

Thorax, tegulae and forewing grey-brown, with some purplish reflection; area posterior to fascia with intensive reflections, darker. Fascia creamy white, rather wide, but slightly varying in shape. Underside of forewing with large cream to yellow elongate spot of androconial scales, further dark grey. Cilia pale grey to grey-cream, lustre. Hindwing totally or partly covered by pale cream scales, underside grey. Abdomen fuscous, valval lobes and anal tufts brown and lustre.

Female. – Forewing length approximately 2.2–2.4 mm. Head: frontal tuft pale ferruginous to pale brown; scape and collar cream; antenna grey-brown to brownish-cream, with 27–28 segments. Thorax, tegulae and small area of forewing base yellowish cream. Hindwing grey. Further as male, except androconial scales.

Male genitalia (figs. 2–5, 7–10). – Capsule 285–315  $\mu\text{m}$  long. Vinculum with shallow anterior excavation. Tegumen narrow. Uncus relatively large, trapezoid, slightly bilobed, surface somewhat papillate dorsally. Gnathos with long posterior processes and short and broad anterior processes. Valva 180–185  $\mu\text{m}$  long, slender triangular, basally joined with juxta, at apex curved medially (inwards), ending in two distinct teeth-like processes. Transtilla with long sublateral processes; transverse bar narrowed in middle. Aedeagus (figs. 3, 4, 5, 9, 10) 275–310  $\mu\text{m}$  long, basally widened; vesica with several large cornuti, varying in shape and size; basally or medially with a group of many spinelike cornuti. Manica absent. Juxta between valvae, joined to valvae and aedeagus, apex bifid, resembling the juxta in *Stigmella viscerella* (Stainton) (Johansson & Nielsen 1990: figs. 247–249). Distally the sclerite with well sclerotised, slightly bifurcated process.

Female genitalia (fig. 6). – Apophyses long, posteriores slightly wider than usually. Accessory sac small,

but distinct. Ductus spermathecae slightly longer than corpus bursae, but very slender, with some narrow convolutions. Corpus bursae relatively small and pectinations on bursae obscure.

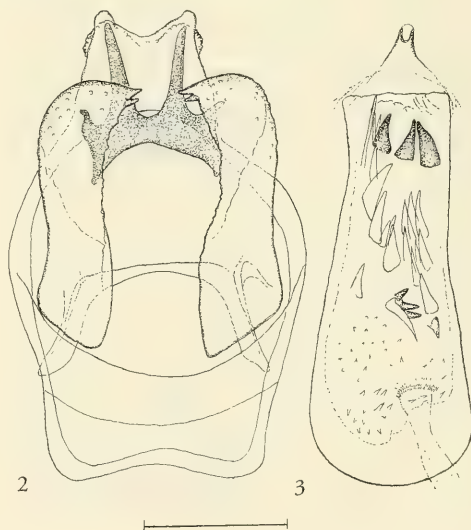
### Biology

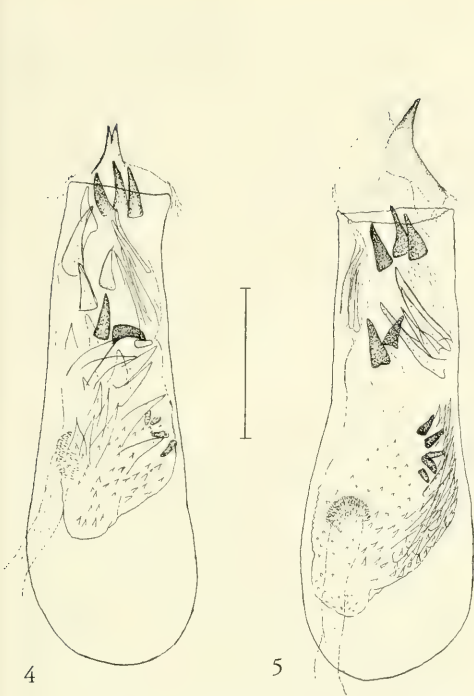
Host-plant unknown. Adults fly from late June to August.

### Distribution (fig. 11)

Turkmenistan (western part of Kopet Dag) and Turkey (Central Anatolia, Sivas province).

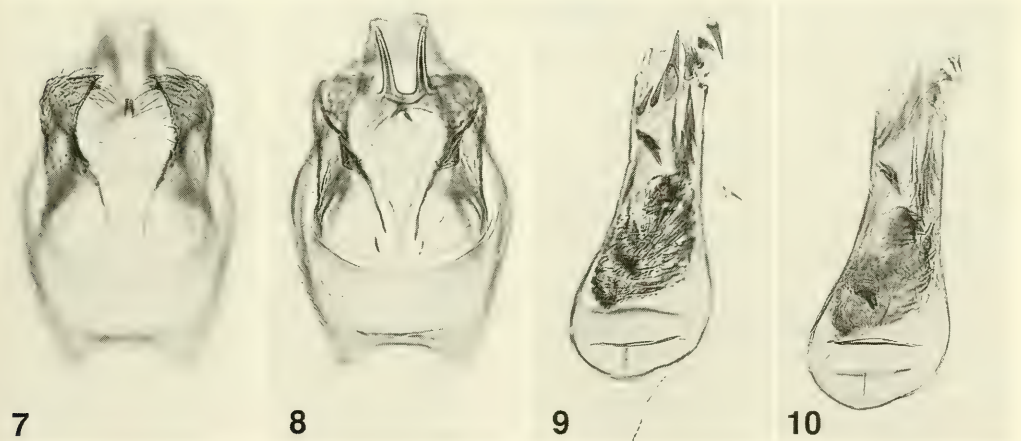
Figs. 2, 3. Male genitalia of *Stigmella divina*, sp.n., holotype (western Turkmenistan). – 2, Capsule; 3, Aedeagus. Scale 0.1 mm.





Figs 4, 5. Aedeagus of *Stigmella divina*, sp.n., paratype, (western Turkmenistan). – 4, Ventral view; 5, Lateral view (same specimen, figured in glycerine). Scale 0.1 mm.

Fig. 6. Female genitalia of *Stigmella divina*, sp.n., paratype (western Turkmenistan). Scale 0.1 mm.



Figs 7-10. Male genitalia of *Stigmella divina*, sp. n., paratype (Turkey), slide EJVN 3180.



Fig. 11.

Distribution of *Stigmella divina*.

## Discussion

We have not been able to determine the position of *Stigmella divina* in any of the currently recognised species groups. It resembles somewhat species in the *S. ulmivora* group, but particularly the valvae and androconial scales are very different. Without a phylogenetic framework for *Stigmella*, we prefer to leave *S. divina* tentatively unplaced within the genus.

## ACKNOWLEDGEMENTS

We are particularly indebted to Roland Johansson, for preparing the water-colours and allowing us to use them. We thank Ole Karsholt for lending us the material collected by Fibiger & Esser. The research presented in this publication was made possible in part by Grant LAO000&LHX100 from the International Science Foundation.

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# MORPHOLOGICAL AND BEHAVIOURAL ADAPTATIONS OF THE GALL MIDGE *LASIOPTERA* *ARUNDINIS* (SCHINER) (DIPTERA, CECIDOMYIIDAE) TO COLLECT AND TRANSPORT CONIDIA OF ITS FUNGAL SYMBIONT

Rohfritsch, O., 1997. Morphological and behavioural adaptations of the gall midge *Lasioptera arundinis* (Schiner) (Diptera, Cecidomyiidae) to collect and transport conidia of its fungal symbiont. – Tijdschrift voor Entomologie 140: 59-66, figs. 1-13. [ISSN 0040-7496]. Published 31 October 1997.

The gall midge *Lasioptera arundinis* attacks lateral shoots of the stems of the reed (*Phragmites australis* Trin.) with the help of its fungal symbiont (of the genus *Macrophoma*). Together with the fungus, the larvae move up the shoot and penetrate into the stem. Thus allowing both organisms access to vascular tissues of the host. The larvae feed on the host tissue and on the fungus and the overwintering larvae are not harmed by the fungal mycelium. This narrow relationship between a gall midge and fungus is an example of obligate mutualism. The female imago and the first-larval instar have evolved specific behavioral traits and structural adaptations to disseminate the fungus. The fungal conidia are collected on upper internodes of galled shoots by the female just before oviposition. The female transports the conidia to an oviposition site in specialized structures on the cercus (tip of the ovipositor). These structures, called mycangia, are composed of a sclerotized plate covered with large spoon-like spines which collect the conidia of the right size and shape. The conidia slide down the collecting spines and enter laterally situated pouches beneath the spines. The mycangia join the extremity of the oviduct such that eggs and conidia are deposited together. The first larval stage with its long bristles and numerous spines carries the fungal material and disseminates it along the feeding route.

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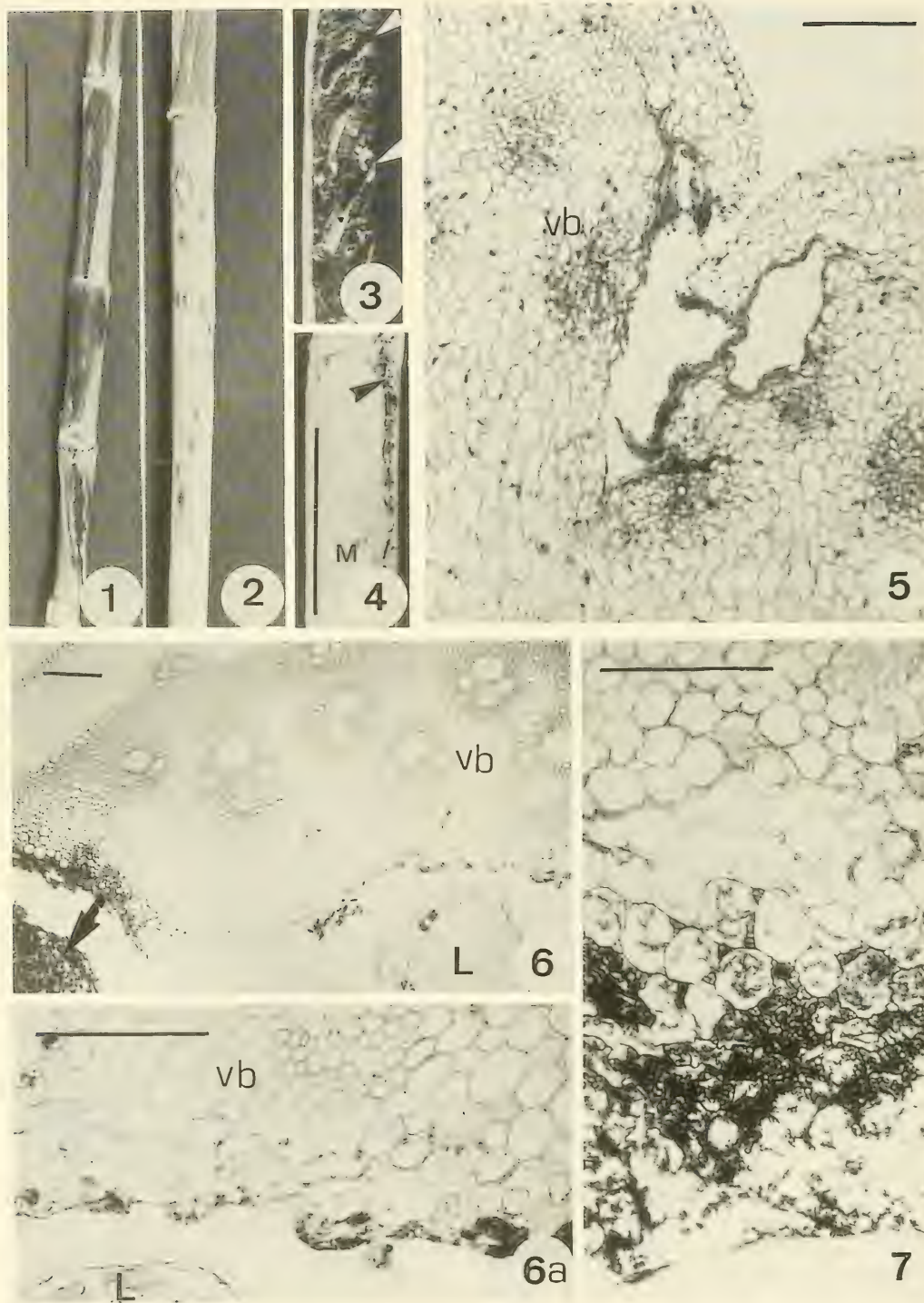
Key words. – *Lasioptera arundinis*, *Phragmites australis*, fungus, mycangia, gall, symbiosis.

There are approximately 4300 described species within the family Cecidomyiidae (Diptera: Nematocera); about half are gall inducers (Felt 1940) and the others are detritus feeders. The ancestral feeding biology of gall midges was thought to be mycetophagy (Mamaev 1968, Gagné 1986, Roskam 1992) whereas the derived taxa belonging to the tribes Cecidomyiinae and Oligotrophini induce galls, as do most of the Lasioterini and all of the Asphondyliini. Many of the Asphondyliini and Lasioterini exhibit a peculiar feature that is reminiscent of the ancestral mycetophagous condition -the surface of their gall chamber is covered with a layer of fungal hyphae on which the larvae feed. These are ambrosia gall midges which are analogous to ambrosia beetles (Neger 1913) that also feed on symbiotic fungi.

Gall midges of the genus *Lasioptera* which often occur on stems of reeds and grasses (Gagné 1989) are usually associated with a fungal symbiont. Meyer

(1952) observed that the gall of *L. rubi* (Schrank) on *Rubus caesius* L. lacked the characteristic layer of nutritive cells found in most galls, and instead a mycelium was present along the surface of the larval chamber with intracellular haustories within tissues of the gall. In contrast, the larvae of some *Lasioptera*, such as *L. berlesiana* Paoli, stay in preformed galleries and feed on a fungal associate that grows in tunnels which begin as tephritid oviposition holes on olives (Solinas 1967). *L. donacis* (Coutin and Faivre-Amiot 1981) feeds on the fungus *Aspergillus niger* V. Tiegh. growing in old galleries of a chloropid fly in leaf sheaths of *Arundo donax* L. (Coutin and Faivre-Amiot 1981). Hermann et al. (1993) described the association of *L. ephedricola* Cockerell with the fungus *Aureobasidium pullulans* (de Bary) Arnaud which forms a dark ring around gall chambers on *Ephedra trifurca* Torr.

Skuhrová and Skuhrový (1981, 1992) described the life cycle of *L. arundinis* Shinner and *L. hungarica*



Möhn which induce galls within stems of the common reed *Phragmites australis* Trin. in central Europe and found that galls of both contain a fungus considered to be of the genus *Sporothrix*. Developmental morphology of the gall of *L. arundinis* has also been described (Rohfritsch 1992) and at the end of this study, it was suggested that the fungus has a narrow and obligatory relationship with the inducer. It was suggested that without the larvae, the fungus would be unable to attack the stem of reeds and that the larvae need the fungus to penetrate to the stem medulla and to obtain food. It is known that the first-instar larvae of *L. arundinis* carry the conidia upwards within the stem and that all nearby larvae follow the same entrance route. However, the question remains as to how the first-instar larvae come in contact with the fungus.

There have been several suggestions as to the mechanism by which fungi are brought into the galls including non-specific air borne inoculation (Batra and Lichtwardt 1963), contamination of the eggs by adult feces (Haridass 1987), and the specific transfer of fungal spores by the ovipositor or abdominal mycangia (Bissett and Borkent 1985). Mycangia are pockets on the bodies of insects that selectively collect and transport fungi (Batra and Lichtwardt 1963). According to Borkent and Bissett (1985), the conidia carried by Lasiopterini are entrapped by two dorso-lateral groups of strong setae on uromer VIII. These authors also observed conidia among the setae of the cercus; however, in another study, Tastás-Duque and Sylvé (1989) were not able to find conidia on the setae of uromer VIII of *L. rubi*. Hermann et al. (1993) found that adults of *L. ephedricola* have structures on their ovipositors which could serve as mycangia, but were unable to find fungal propagules on the ovipositors of newly emerged females. Hermann et al. (1993) concluded that host leaves were the source of fungi for either newly hatched larvae, or females prior to oviposition, or that oviposition occurs on or near an inoculum source.

The purpose of the present paper is to demonstrate that: 1) females emerging from their pupae do not

carry the fungus, 2) females collect conidia on the upper internodes of attacked shoots, 3) mycangia are present on the cercus which selectively collect conidia from the epidermis of the leaf sheath, 4) conidia and eggs are deposited simultaneously, 5) larvae disseminate the fungus along the dispersal route and aid its progress into the stem.

## MATERIAL AND METHODS

### Insect rearing

Lateral shoots of common reed attacked by *L. arundinis* were collected in January from the 'Parc de Pourtales' near Strasbourg, France. The whole shoots, about 25 cm long, were kept at room temperature (22°) in a glass jar covered with muslin under natural daylight.

### Preparation for light microscopy

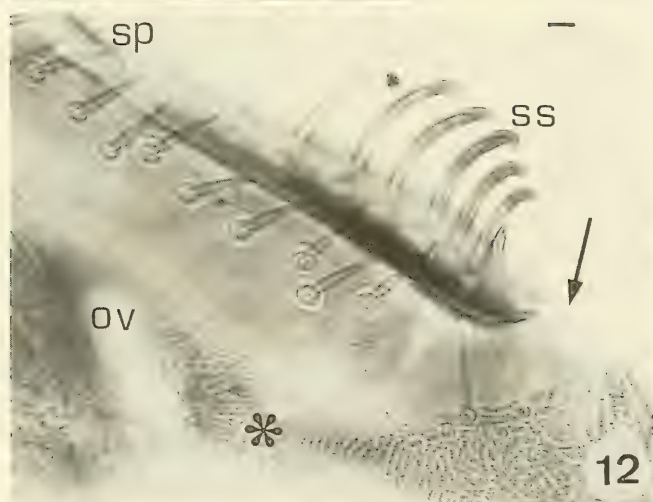
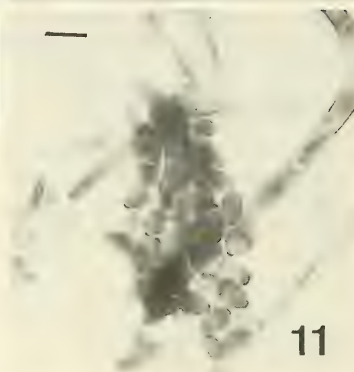
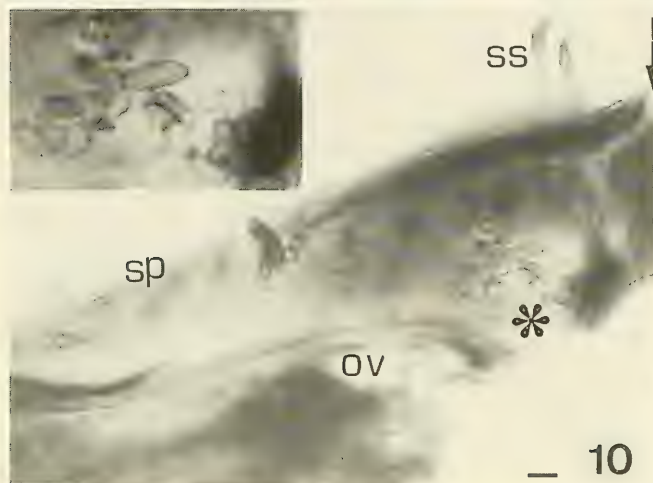
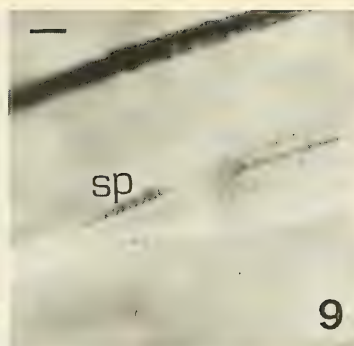
Non-fixed material. – The fungal flora present on the leaf sheaths was observed in one of the staining solutions described below either separately from the plant or on a peel of the epidermis. The appendages of the ovipositor and the cercus were observed in a similar way. Stains used were: (1) cotton blue which selectively stains the fungal mycelium, (2) lactic reagent (Gazet du Châtelier 1948, Rohfritsch 1992b), which makes the tissue partially transparent and stains starch, oils, cutin and lignin, (3) toluidine blue which stains nucleus, cytoplasm and cell walls.

Fixed material. – Fixative: Formaldehyde-Alcohol-Acetic acid (ethanol 70% 90 ml, glacial acetic acid 5 ml, formaldehyde 5 ml). Portions of the internodes (about 3 cm long) were fixed over a period of 24 h at room temperature. Smaller pieces of the fixed material (1 cm) were embedded in paraffin and sectioned in 3–5 µm slices with a microtome (Jung, Heidelberg) and transferred to glass slides. After paraffin removal, the sections were stained with toluidine blue or with safranin-light green.

Dissections were photographed with a Zeiss Tessovar while histological sections were photographed with a Leitz microscope.

Figs. 1-7: Lateral shoots of common reed attacked by *Lasioptera arundinis* and its associated fungus. Bar scale: 0.5 cm for Figs. 1-4, 100 µm for Figs. 5-7. – 1, Attacked shoot with mature larvae, basal internodes. The fungal mycelium has plugged the entrance split; 2, Upper internode of the attacked shoot. The fungus has grown through the leaf sheath and conidia are present on the epidermis; 3, Dissection of an internode filled with fungus, which contains numerous larval chambers (arrows); 4, Dissection of an upper internode. The fungus (arrow) is only present in the stem cortex, without the larva it does not reach the medulla (M). – Figs. 5-7: Cross sections of galled stems; 5, Section through the cortical tissue of a young reed stem. Both larvae and fungus have penetrated the medulla. The entrance cavity is covered by the fungal mycelium. The vascular bundles (vb) are accessible to the feeding larva; 6, Section through a maturing gall. All stem cells are hypertrophied. The entrance split is filled with a mat of black mycelium (arrow). The fungus has attacked the most inward vascular bundles (vb). The larva is feeding on young fungal hyphae growing on the plant tissue; 6a, Detail of fig. 6 showing the larval feeding site; 7, Section through a mature gall. The larva has stopped feeding, the black fungal mycelium fills the whole medullar cavity.





## RESULTS AND DISCUSSION

**Biology of *L. arundinis* and gall development**

Larvae of *L. arundinis* and its associated fungus produce a thickening and shortening of lateral shoots of common reed. Galls are made from hypertrophied stem tissue and hypertrophied medulla (figs. 1 and 3). There are 1 to 25 larvae per internode, with most larvae found in the central part of the shoot. Each internode constitutes one larval chamber in young galls. Later, the proliferating fungus isolates each larva in an individual chamber, so that the mature gall appears as multi-chambered. The uppermost internodes are free of larvae and fungi but between galled and normal tissues 1 or 2 internodes are superficially attacked by the fungus (figs. 2, 4). Overwintering larvae use their spatula to bore an exit hole in mid-May. Adults exit the gall at the end of June. Only lateral shoots damaged at their tops by other invertebrates are attacked. Each female lays from 60 to 110 eggs under the basal leaf sheath (Skuhravá & Skuhravý 1981). All freshly hatched larvae move along the same route towards the apex. The larvae carry conidia and disseminate the fungus along their route. In addition, the larvae attack the plant tissue with their mandibles, creating a stress and a discrete wounding on the plant epidermis. The fungus is now able to penetrate into the epidermis and invade the cortical tissue of the stem (Rohfritsch 1992). With the help of the fungus, the larvae enter the stem and move upwards; the fungus produces a longitudinal gallery in the cortical tissue which allows the larvae to progress through the nodes of the stem upwards. The fungus produces cell disso- ciation and the larval activity enlarges the cavity (fig. 5). Both organisms enhance proteosynthesis of adjoining cells, with some cells developing the cytological characteristics of nutritive cells. When the third-instar larvae reach the medulla, the fungus invades the medullar parenchyma and the innermost vascular bundles (figs. 6, 6a). The mycelium soon covers the larval cavity and fills the medulla once the larvae stop feeding (figs. 3, 7) (Rohfritsch 1992).

**Emergence of the gall midge and conidia collection**

Attacked shoots were collected at the end of January and observed regularly each week. Within 2 weeks, the larvae bored exit holes through the fungal mycelium and the leaf sheaths, except the outermost sheath. Adults exited the galls 3 weeks later. Males emerged first and newly emerged females were free of fungal material. The ovipositor was retracted after mating, then the females flew about and finally alighted on the leaf sheath of an upper shoot internode. The ovipositor was extruded and the surface of the leaf sheath was palpated. The visited internode was not galled but the fungus was present along a narrow strip in the stem cortical tissue. From this superficially located infection, the fungus had grown through the leaf sheath and produced mycelium and conidia on the epidermis (figs. 2, 11). As was generally observed with ambrosia gall midges (Borkent & Bissett 1988), we never observed *L. arundinis* picking up fungal material directly from the gall surface. The observed *Lasioptera* gall midge found the fungal conidia on the galled host plant but not on the gall directly. It is not known how the females distinguish the 5 or more different fungi present on the surface of the same leaf sheath.

**Mycangia**

Borkent & Bissett (1988) reported that female *Lasioptera* species use specialized structures located on uromer VIII of the female abdomen to carry conidia and transfer them to the host plant during oviposition. Like Tastás-Duque & Sylvén (1989), I was unable to find conidia on uromer VIII, even after the female had visited the upper internodes of the galled shoot (fig. 9). However by examining the whole ovipositor in lactic reagent, I found distinct mycangia on the cercus near the tip of the ovipositor, close to the outlet of the oviduct (figs. 8, 10, 12). The paired mycangia were made up of pockets located beneath the sclerotized plate which carried large spoon-like spines. These spines have been previously observed

Figs. 8-13: Structural adaptations of *Lasioptera arundinis* for carrying fungal symbiont. Bar scale : 50µm in figs. 8 and 9, 10µm in all other figures. — 8: Posterior part of the ovipositor with the mycangial structures on uromer X. The superior lamella of uromer X is covered with spines (sp) and spoon-like sensilla (ss). The apical portion of the superior lamella is covered with sensory hairs (sh). Arrow indicates the entrance into the mycangia. Asterisk indicates the outlet which joins the oviduct. The ovipositor was processed in lactic reagent, and photographed in ethanol; 9: Portion of ovipositor showing spines (sp) on uromer VIII; 10: Mycangial pouch on uromer X. The conidia are collected by the spoon-like spines on the sclerotized plate. The conidia glide down the spines and enter the pouch (the entrance is indicated by an arrow). During oviposition, the conidia leave the pouch via the outlet (asterisk) which joins the oviduct (ov). Stain: lactic reagent. Insert: Detail of the conidia present in the mycangial pouch; 11: Conidia observed on the leaf sheath of the upper internode of the attacked shoot. This is the same internode shown in fig. 2. Stain: lactic reagent; 12: Same mycangia as in fig. 10, mycangia were observed in ethanol after treatment with lactic reagent, (the conidia have been removed) ss: spoon-like spines, ov: oviduct. Entrance into the mycangia is indicated by an arrow; outlet indicated by asterisk; 13: Section of first-instar larva (L) showing long bristles and numerous spines.

on other *Lasioptera* species (Skuhravá & Skuhravý 1981, Tastás-Duque & Sylén 1989); however, the pockets just beneath the spines have not been seen. I found a few conidia on the spoon-like spines and at least 30 conidia of the same type in each pocket beneath the spines. The shape and the size of conidia corresponded with the shape of the spines. The spines evidently pick-up the conidia when the ovipositor laterally palpates the surface of the leaf sheath, retaining only conidia of the right size and shape. The conidia then slip to the base of the spine and, with the help of other spines, are guided into the cavity opening at the top of the two laterally situated pouches, beneath the sclerotized plate (fig. 10). Five females were examined and only one type of conidia was present in their mycangia. Small fragments of mycelium were sometimes present. An exit hole at the bottom of the mycangia joins the extremity of the oviduct (figs. 10, 12) such that during oviposition both eggs and conidia are deposited.

The mycangia of *L. rubi* are similar to the structures described above. Because the female could not find its fungal symbiont on the gall surface or along nearby plant surfaces, the mycangia were empty (unpublished results).

### Fungus

The fungus previously associated with this gall was described as belonging to the genus *Sporothrix* of the Deuteromycetes (Skuhravá & Skuhravý 1981); however, the size and shape of the conidia are similar to those of the genus *Macrophoma* (Borkent & Bissett 1988). Borkent & Bissett suggested that the fungal genus *Macrophoma* was specifically associated with the ambrosia gall midges. The conidia carried by *L. arundinis* had a distinct terminal structure, a sort of dense rim at their top (fig. 11). Otherwise, the conidia shared the characteristic features of *Macrophoma* conidia, as described in Borkent & Bissett (1988) with similar shape, a truncated base, indicative of holoblastic ontogeny, they were first hyaline and aseptated, and at later stages developed brownish pigments and one septa. According to Borkent & Bissett these ambrosia fungi may be referred to the coelomycetes anamorphous genera and all the anamorphous observed in the gall midge mycangia could be considered congeneric.

The nutrition of the fungus was biotrophic and it was feeding inter- and intracellularly without ever killing the cells. The fungus had long slender 'prospektiv' hyphae which dispersed intercellularly, and were directed straight to the vascular bundles. These hyphae produced cell wall dissociation. Along this open route and especially near the larvae, large cytoplasm-enriched hyphae developed intercellularly with haustoria inside the cells. Near the end of lar-

val development, the old, highly chitinized mycelium formed a dense mat along the medullar cavity and, once the larvae stopped feeding, they filled the cavity. This mycelium was unable to fruit on the gall surface. Along the entrance canal, the plant reacted by lignifying its cell walls such that the fungus was stopped in its lateral progression.

Thus the fungus can only develop towards the center of the stem. From the medulla the fungus attacked only the innermost vascular bundles and fructification did not occur. No larvae were observed along the youngest attacked internodes; the fungus invaded only the cortical parenchyma and produce a superficial gallery along the internode. From here the fungus was able to produce fructifications by growing through the leaf sheath (figs. 2,4, 11).

### Fungal dispersion via the larva

First-instar larvae have unusually long bristles and many spines (fig. 13), between which fungal material was found. It is via these bristles and spines that the fungus comes in contact with the young epidermis of the host. Larval activity also results in cell wounding (Rohfritsch & Shorthouse 1982, Rohfritsch 1992) which allows the fungus to invade the reed stem. Larvae later help the fungus to reach the different layers of vascular bundles and finally the medulla. The fungus is apparently unable to join the medulla without the larvae and can not progress up the stem (fig. 4).

Galls of *L. arundinis* on the stems of reed appear to be ambrosia galls. As in the case of ambrosia beetles, the gall midge collects and carries its symbiont in specialized structures: the mycangia. This is the first reported observation of fungal collecting and transporting behaviour by gall midges and also the first description of mycangial pouches in the genus *Lasioptera*. These fungus collecting structures are localized on the cercus. They are composed of two lateral pouches, associated with spoon-like setae. These large hooked setae have also been observed on *L. hungarica* (Skuhravá & Skuhravý 1981) and *L. rubi* (Tastás-Duque & Sylén 1988) where they were thought to serve as sensilla which register chemical stimuli both by olfaction and contact. My observations have shown that the sensilla are able to discriminate the fungal conidia not only by olfaction but also by their shape and size and thus they may help the midge to find its symbiont on the leaf sheath of the right internode. It is possible that chemical signals are involved in recognizing the correct fungal symbiont. Thus it is incorrect to conclude that the ovipositor picks up fungal conidia similar to the way in which a finger picks up objects when it is run across a surface.

The gall of *L. arundinis* is therefore a model of mu-



tualistic association between a gall midge and its fungal symbiont where both organisms feed and develop on the stems of reed. Together they are able to enter into the stem tissues and feed on vascular tissues with the midge larvae also feeding on the fungus; they first feed on young, tender hyphae budding in the larval chamber and later on the older mycelium (Rohfritsch 1992). The larvae do not only use the mycelium to enter the reed stem and locate food, but to attain protection as well. In this association, the fungus is dispersed into a highly specialized and protected niche. With the help of gall-midge larvae, it gains access to young tissues of the elongating shoot.

It also is apparent that coevolution between gall midges and fungi has taken place as evidenced by physical traits such as the mycangia of the imago and the long bristles and spines of the larvae. There are also behavioural traits of the insect for collecting and carrying specific fungal spores and to inoculate them in a specific manner in the plant tissue along a line which is the larval dispersal route. Success of this plant–fungus–larva interaction is mainly dependent on larval behavioral traits. The fungus is controlled by plant defense reactions and by the larvae and, the insect appears to control physiological processes and morphogenetic expression of the fungus including conidia germination, stimulation of mycelial growth and control over this growth.

Ambrosia gall midges have evidently evolved the means of using and manipulating the fungus, and the fungus may have reciprocated by evolving similarly accommodating traits such as fructifications on upper internodes of attacked shoots, along with a particular size and structure of conidia. The fungus in turn shifted from a saprophytic to a biotrophic mode of life and has avoided plant defense reactions. The fungus now remains under the control of the gall midge to avoid competition for food and space and the proliferating dense mycelium never destroys the overwintering larvae.

Thus ambrosia galls such as this result from the activity of both the insect and the fungus. Cell wall maceration is produced by the fungus but cell activation to high proteosynthesis which characterize nutritive tissues of most gall-inducing insects can also be induced by biotrophic fungus. Furthermore, the hypertrophic gall growth may result from the activity of both organisms. The fungus does not reach the medulla in the upper internodes where it develops without the larva; it does not develop a thick mycelium and has less influence on growth of the internode. Consequently, both organisms stay in a narrow mutualistic relationship. The fungus is collected, transported and deposited via highly evolved mycangia. According to Bissett & Borkent (1988), all *Lasioptera* carry the same kind of conidia, all from the genus

*Macrophoma*. It thus can be speculated that all *Lasioptera* female imagoes have mycangia beneath the spoon-like spines on their cerci. To observe the conidia in the mycangia, it is necessary to give the midge the opportunity to collect them and it is essential to avoid ethanol for material preservation or observation.

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THE COCKROACH GENERA *PSEUDOTHYRSOCERA*  
SHELFORD, *HAPLOSYMPLOCE* HANITSCH,  
AND *EPISYMPLOCE* BEY-BIENKO  
(BLATTARIA: BLATTELLIDAE, BLATTELLINAE)

Roth, L.M. 1997. The cockroach genera *Pseudothyrsocera* Shelford, *Haplosymploce* Hanitsch, and *Episymploce* Bey-Bienko (Blattaria: Blattellidae, Blattellinae). – Tijdschrift voor Entomologie 140: 67-110, figs. 1-123 [ISSN 0040-7496]. Published 31 October 1997.

Twelve species of *Pseudothyrsocera* are redescribed and one new species, *P. perkinsi*, is described. A key is given to identify the males. The genus is divided into two species groups. *Leptothyrsocera* is a junior synonym of *Pseudothyrsocera*. *Ischnoptera sinensis* Walker (= *Episymploce sinensis*) is transferred to *Pseudothyrsocera*.

Eight species of *Haplosymploce* are redescribed, and a key to males is given. New synonyms are: *Symploce bicolorata* Roth is *Haplosymploce montis* (Shelford), and *Symploce ferruginea* Roth is *Haplosymploce nigra* (Hanitsch). *Mopsera andamanica* Princis, *Pseudomops pica* Walker, *Pseudothyrsocera ruficollis* Shelford, and *P. moultoni* Hanitsch are transferred to *Haplosymploce*. *Haplosymploce guttifera* (Walker) is *Beybienkoa guttifera* [= its junior synonym *Beybienkoa papuensis* (Roth)], and *Haplosymploce walkeri* Princis is *Hemithyrsocera walkeri*.

Two new species of *Episymploce*, *E. simmonsii* n. sp. and *E. parafissa* n. sp., are described and several species of *Symploce* are transferred to that genus. Several new records of *Episymploce* are given. Lectotypes are designated for the following species: *Pseudothyrsocera montana* Shelford, *Pseudomops pica* Walker, *Thyrsocera circumcincta* Stål, *T. lugubris* Stål, *T. rufiventris* Stål, *T. semicincta* Stål, *Ischnoptera montis* Shelford, and *I. nigra* Hanitsch.

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Key words. – *Pseudothyrsocera*, *Haplosymploce*, *Episymploce*, Blattellidae; cockroaches; taxonomy; redescriptions; new species; new combinations; new records.

This work is a continuation of my studies of cockroaches from the Indo-Australian regions. Two genera, namely, *Pseudothyrsocera* Shelford and *Haplosymploce* Hanitsch, are revised. A third genus, *Episymploce* Bey-Bienko, is included because some of its diagnostic characters are similar to these two genera.

In this paper I redescribe 12 species of *Pseudothyrsocera*, describe one new species, and provide a key to distinguish the males. *Leptothyrsocera* Princis is a synonym of *Pseudothyrsocera*. I have divided *Pseudothyrsocera* into two species groups, one of them having characters annectant to *Episymploce*.

I recognize ten species (one with a query) of *Haplosymploce* and redescribe eight of them; *Pseudothyrsocera andamanica* (Princis) belongs in *Haplosymploce*. *Symploce bicolorata* Roth is *Haplosymploce montis* (Shelford), and *Symploce ferruginea* Roth is *Haplosymploce nigra* (Hanitsch).

Two new species of *Episymploce* are described, and

several species of *Symploce* are transferred to that genus.

The following museums and their curators or collection managers loaned me specimens: ANSP - Academy of Natural Sciences of Philadelphia, PA, U.S.A.; Mr. Donald Azuma; BPBM - Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.; HECO - Hope Entomological Collections, Oxford University, England; Dr. George C. McGavin and Mr. I. Lansbury; MCZC - Museum of Comparative Zoology, Harvard University, Cambridge, MA, U.S.A.; MNHG - Museum für Naturkunde, Humboldt-Universität zu Berlin, Germany; Dr. Kurt Günther; NMWA - Naturhistorisches Museum Wien, Vienna, Austria; Dr. U. Aspöck & Dr. A.P. Kaltenbach; NRSS - Naturhistoriska Riksmuseet, Stockholm, Sweden; Per Inge Persson; RMNH - National Museum of Natural History (Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands; Mr. J. van Tol; ZILS -



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#### SYSTEMATIC PART

#### Key to genera *Pseudothyrocera*, *Haplosymploce*, and *Episymploce*

1. Radial vein of hind wing simple (figs. 8, 10) or sometimes with a pseudoposterior branch (fig. 41). Intercercal processes present (fig. 82) or absent (fig. 3) ..... 2
- Radial vein of hind wing with a distinct posterior branch (fig. 112). Intercercal processes absent (fig. 116) ..... *Episymploce*
2. Hind wing cubitus vein with one or two complete and usually no (rarely 1) incomplete branches (figs. 8, 10, 16). Intercercal processes absent (figs. 18, 46) ..... *Pseudothyrocera*
- Hind wing cubitus vein with four to seven complete and two to four incomplete branches (fig. 89). Intercercal processes present (fig. 79) ..... *Haplosymploce*

#### Genus *Pseudothyrocera* Shelford

*Pseudothyrocera* Shelford, 1906: 250.- Princis 1951: 54 (footnote, selected type species, *Blatta xanthophila* Walker), 1969: 953 (literature).

*Mopsera* Hebard, 1929: 78. Type species: *Phyllodromia rectangulariter-vittata* Brunner, by monotypy.

*Leptothyrocera* Princis, 1965: 152. Type species: *Pseudothyrocera fulva* Hebard, by monotypy. *Syn. n.*

**Diagnosis.** — Some of the antennal segments may or may not be plumose. Tegmina and wings narrow, fully developed, the former with simple, straight radial vein, discoidal sectors longitudinal (fig. 32). Hind wing with radial vein simple, or questionably branched, straight, media vein simple or forked, cubitus vein with mostly one or two, and usually no or rarely one incomplete branches, apical triangle absent or subobsolete; anterior field comparatively narrow (figs. 8, 10, 16). Front femur usually Type B<sub>1</sub> (fig. 20d), rarely Type A, (fig. 12), B<sub>2</sub>, or intermediate between A and B (figs. 20a-d); pulvilli on four proximal tarsomeres of all legs, tarsal claws simple, symmetrical, arolia present, may be greatly reduced. Male: first and seventh abdominal terga specialized (figs. 15, 17), or only the seventh with a tergal gland (fig. 28). Supraanal plate symmetrical, paraprocts dissimilar, intercercal processes absent (fig. 11). Subgenital plate (visible portion in the pinned specimen) usually is asymmetrical, or nearly so, its shape variable (e.g.,

figs. 6, 14, 26, 37, 42). One (figs. 26, 35, 37) or usually two styles are present, and if the latter they are similar (figs. 29, 47) or dissimilar (fig. 14). Genitalia with three distinct phallomeres (e.g., fig. 37): genital hook on the left side, with a preapical incision (fig. 6); median phallomere simple (e.g., fig. 14), or bifurcate on distal half (figs. 6, 19, 37); right phallomere consisting of two or more sclerites, one of them often a cleft (e.g., fig. 19).

**Remarks.**— Princis (1965: 152) erected the monotypic genus *Leptothyrocera*, and designated *Pseudothyrocera fulva* Hebard as its type species. He selected the following characters given by Hebard in his description of *fulva* as the diagnostic features of the genus: Tegmen with the cubitus vein at the distal end of the anal field geniculate (abruptly bent in an obtuse angle) and there giving off a vein. Radius of hind wing with a bifurcation. Front femur Type B<sub>1</sub> [the front femur of *fulva* is Type B<sub>2</sub>, Type B<sub>3</sub>, or intermediate between Types A and Type B (figs. 20a-d)]; four proximal tarsomeres of the hind tarsi with very small pulvilli, tarsal claws symmetrical, unspecialized, arolia very small. Princis stated that *Leptothyrocera* can be separated from *Pseudothyrocera* by bifurcation of the radius vein of the hind wing. The geniculate cubitus of the tegmen may be found in some species of *Pseudothyrocera* (e.g., fig. 32). Sometimes it is difficult to decide whether or not the radius is bifurcated. Rehn (1951: 20) states that the radius usually has an apical posterior branch which may be either simple or show secondary divisions, and at times it has become indistinguishable or lost; his drawing (fig. 2) shows the branch distinctly projecting posteriorly between the radius and media veins. There is no question that the radius is bifurcated if the branch arises somewhere along its length and extends posteriorly between it and the media vein, as is characteristic of most *Episymploce* (fig. 112), *Hemithyrocera* (fig. 108) and many other genera. The radial veins of species of *Pseudothyrocera* are essentially unbranched. In *Pseudothyrocera fulva* the so-called bifurcation continues as a straight line from the radius and does not project distinctly posteriorly between the radius and media; the penultimate apical ramus with its five small branches (in the ♂) is widely separated from the small terminal vein (Hebard 1929: pl. 6, fig. 2) and both Hebard and Princis consider the vein to be bifurcated; I interpret this type of radial vein as having a pseudoposterior branch (figs. 41, 45). The lengths and branching of the apical rami of the radius (Rehn's 1951 terminology) may vary among species (e.g. figs. 8, 16, 31, 41, 45), and the branch may protrude very slightly posteriorly. The presence of one additional small terminal spine on the anteroventral margin of the front femur (Type B<sub>1</sub>) in

*Leptothyracera* is of no generic importance here because these small stout spines may or may not be present or are about the same length as piliform spinules (figs. 20a-d). I can see no distinct differences between *Leptothyracera* and *Pseudothyracera* and I consider the former a junior synonym. Hebard (1929) included only the type species in *Mopsera* and suggested that *Phyllodromia castanea* Brunner (listed with a query in Princis's catalog) might also belong in this genus. Princis (1969: 954) listed *Mopsera* as a synonym of *Pseudothyracera* and I agree with him. The genus *Mopsella* Hanitsch (1936: 394) which Bruijning (1947: 226) renamed *Hanitschia*, because the original name was preoccupied, is nearest to *Mopsera* according to Hanitsch (1936: 394): 'Points of agreement between *Mopsella* and *Mopsera* are: small size and delicate structure; broad interocular space; simple, not plumose, antennae; narrow and elongate tegmina and wings; radial vein of tegmina and wings simple (i.e., not forked); discoidal sectors of the tegmina longitudinal; ulnar [= cubitus] vein of hind wings with complete branches; apical triangle absent. The chief differences are: *Mopsella* has a broad, not elongate pronotum; its hind femora are weakly spined (front femora missing); the costal and axillary veins of the wings are much fewer in number than in *Mopsera*.' The so-called differences between these two genera do not clearly separate them and they are most likely synonyms (of *Pseudothyracera*). Unfortunately, the type species, *Mopsella toxopei* Hanitsch, is known only from a unique female and the male should be examined before a final decision can be made regarding its correct generic placement.

The male genital hook of *Pseudothyracera* is on the left side which places it in the Blattellinae of McKittrick's (1964) system. I divide *Pseudothyracera* into the following two species groups and their subgroups:

1. *fulva*-species-group. – Subgenital plate variable in shape, the exposed portion (in the pinned specimen) not distinctly trigonal, without a process midway on the thickened left lateral margin (figs. 14, 19). One (fig. 37) or two styles (fig. 19) present.

Subgroup (a). Only the seventh abdominal tergum specialized. – Species: *perkinsi*; *rubronigra*; *xanthophila*.

Subgroup (b). Abdominal terga one and seven specialized. – Species: *fulva*; *rectangularitervittata*; *scutigera*.

2. *lugubris*-species-group. – Visible portion of the subgenital plate trigonal, usually with a process midway on the lateral margins, left side incrassate, with a pair of similar or dissimilar or similar styles usually close together at the apex (figs. 47, 56), or sometimes

more widely separated (fig. 67).

Subgroup (a). Only the seventh abdominal tergum specialized. – Species: *circumcincta*; *henrici*; *lugubris*; *rufiventris*.

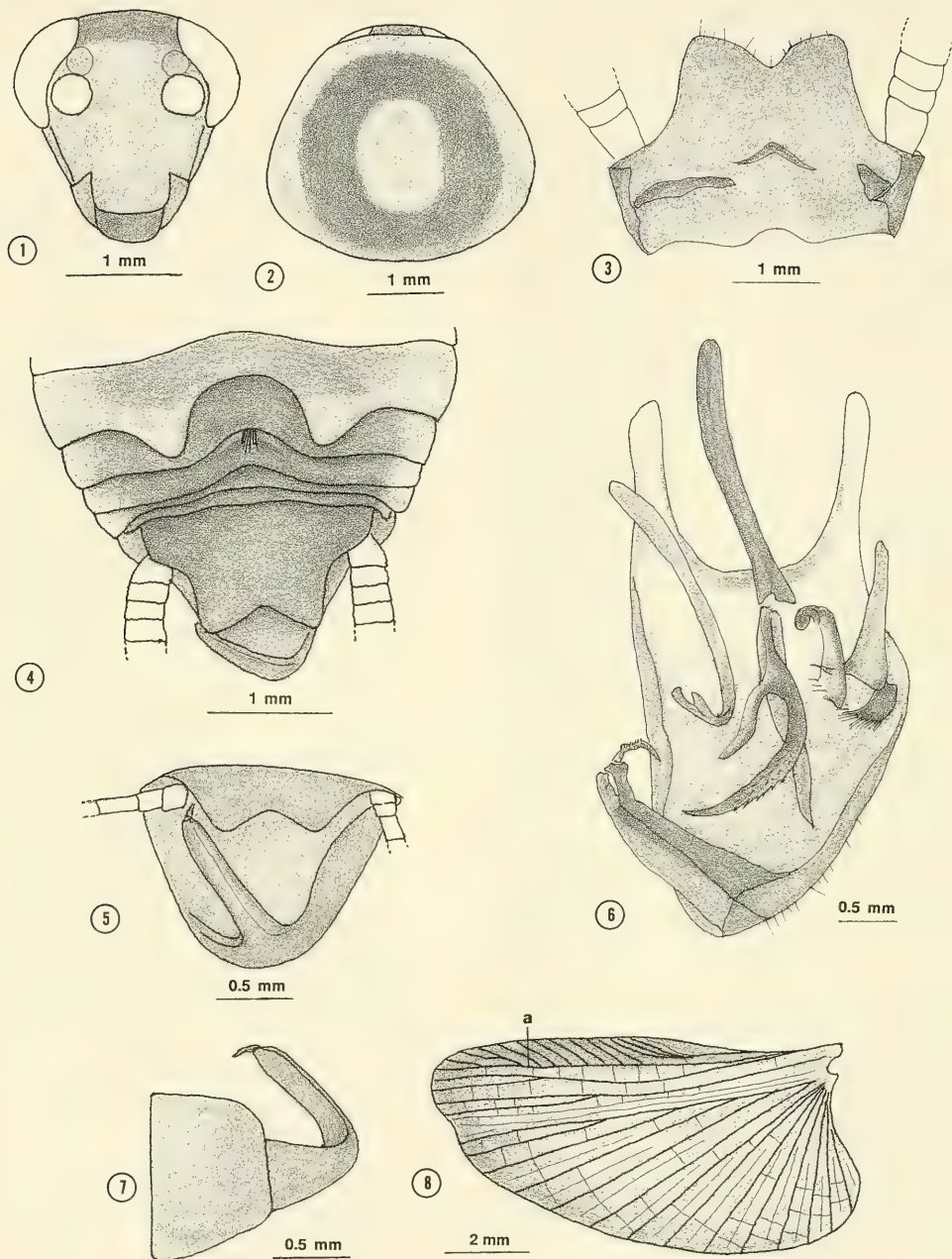
Subgroup (b). Only the first abdominal tergum specialized. – Species: *sinensis*.

Subgroup (c). First and seventh abdominal terga specialized. – Species: *montana*.

The *lugubris*-species-group has subgenital plates and styles similar to those of many species of *Episymploce* and they may be a link between *Pseudothyracera* and *Episymploce*.

### Key to males of *Pseudothyracera*

1. Shape of the exposed portion of the subgenital plate variable, not trigonal, left side not thickened and without a process midway on the lateral margin, with one or two styles (Figs. 14, 19, 26) (*fulva*-species-group) ..... 2
- Shape of the exposed portion of the subgenital plate trigonal, the left side thickened and with a lateral process near the middle of the margin (except in *henrici*), two styles present (figs. 42, 47, 49, 56, 67) (*lugubris*-species-group) .. 7
- 2 (1). Tergal gland on segments one and seven (figs. 15, 17) ..... 3
- Tergal gland only on segment seven (figs. 9, 28, 34) ..... 5
- 3 (2). Apex of the subgenital plate with a very large process that is upturned obliquely to the left and bearing a minute terminal style, second style absent (figs. 5-7). Pronotal disk with a broad, dark, round, O-shaped macula (fig. 2) ..... *rectangularitervittata*
- Subgenital plate, styles, and pronotum not as above ..... 4
- 4 (3). Apex of supraanal plate with a pair of small contiguous styles (fig. 19). Supraanal plate as in fig. 18. Pronotal disk without a dark macula ..... *fulva*
- Apex of subgenital plate roundly produced, with a minute spinelike style at the apex (fig. 26). Pronotal disk with a large, dark macula (fig. 21) ..... *scutigera*
- 5 (2). Subgenital plate rounded apically, with a small spinelike style on the right posterolateral corner and a minute hidden style medially (figs. 13, 14). Supraanal plate as in figs. 9, 11 .... *xanthophila*
- Subgenital and supraanal plates not as above ..... 6
- 6 (5). Hind margin of subgenital plate rounded, not produced, medially with a pair of similar, almost contiguous styles (fig. 29) .. *rubronigra*



Figs. 1-8. *Pseudothyrsocera rectangularitervittata* (Brunner), males from Kuching, Sarawak: 1, head; 2, pronotum; 3, supraanal plate and paraprocts (ventral); 4, abdominal terga five to ten and subgenital plate (dorsal); 5, supraanal and subgenital plates (end view); 6, subgenital plate and genitalia (dorsal); 7, elongated process of the subgenital plate, and penultimate sternum (left lateral view); 8, left hind wing [a = simple (unbranched) radial vein].



- Apex of subgenital plate produced and bearing at its apex a large, broad style, second style absent (figs. 35, 37) ..... *perkinsi*
- 7 (1). Abdominal terga one and seven specialized. Supraanal plate and paraprocts as in fig. 55 ..... *montana*
- Only abdominal tergum one or seven specialized. Supraanal plate and paraprocts not as above ..... 8
- 8 (7). Only abdominal segment one specialized (fig. 1B in Roth 1987c). Styles similar, very large, close together (fig. 1D in Roth 1987c) ..... *sinensis*
- Only abdominal segment seven specialized. Styles not as above ..... 9
- 9 (8). Left style elongated, spinelike, erect, located at the apex of the subgenital plate, right style well separated from it; midway on the left and right margins of the subgenital plate without a membranous process (fig. 67) ..... *henrici*
- Left style not as above, both styles close together at the apex of the plate; a small membranous process is located midway on the left margin of the subgenital plate (a process occurs on the right side, but it may be greatly reduced or subobsolete) (figs. 47, 49, 56) ..... 10
- 10 (9). Pronotum completely dark or with a very narrow yellowish line along the anterior margin (fig. 38). Supraanal plate and paraprocts as in fig. 40 ..... *rufiventris*
- Pronotum dark, with a distinct pale ring around the entire border of the disk (figs. 43, 48) ..... 11
- 11 (10). Supraanal plate with median region roundly produced, the curved hind margin with a row of dark setae (fig. 50). Abdominal terga and sterna orangish ..... *circumcincta*
- Supraanal plate as in fig. 46. Abdominal terga reddish brown or black, sterna reddish ..... *lugubris*

# *fulva*-species-group

*Pseudothyrsocera rectangularitervittata* (Brunner)  
(figs. 1-8)

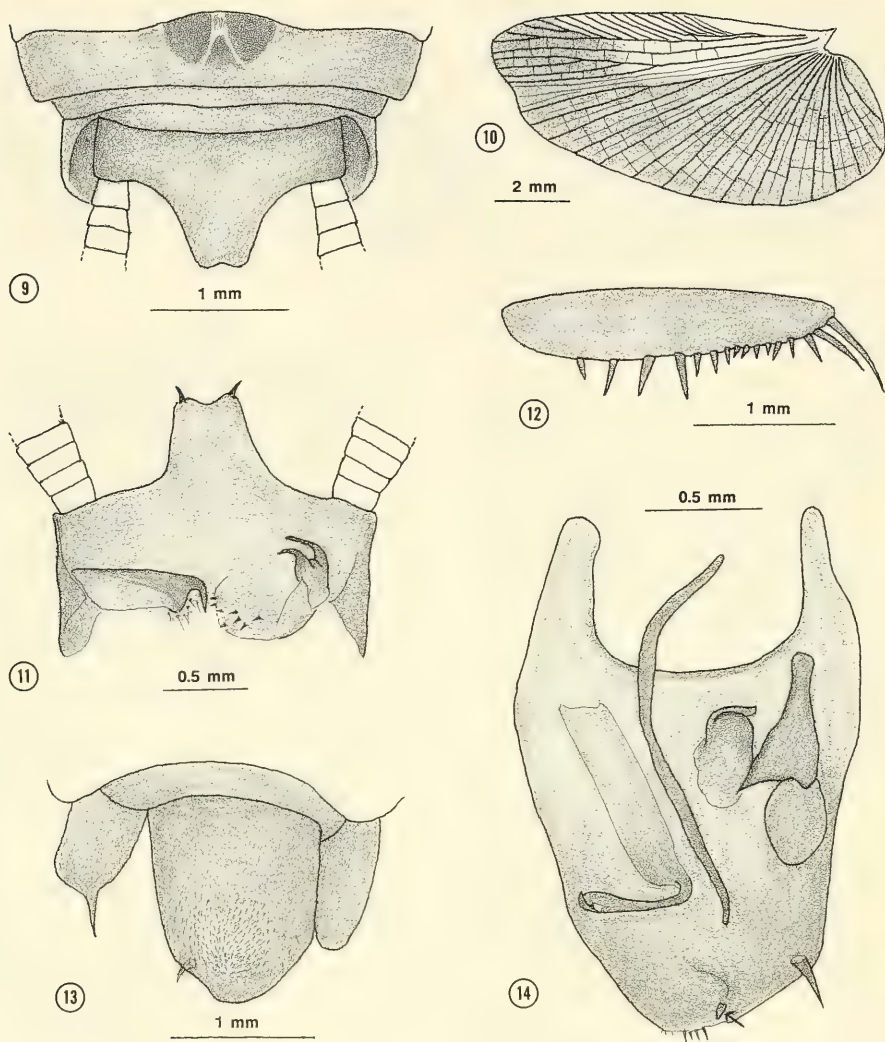
*Phyllodromia rectangulariter-vittata* Brunner, 1898: 203, pl. XVI, fig. 3 (female) (p. 107, *recte vittata* Br., *lapsus calami*). Holotype ♀ [not examined], Baram, N.W. Borneo (Sarawak); probably in the Genoa Museum, Italy. – Kirby 1904: 91; Shelford 1908a: 13; Hanitsch 1923: 411. *Mopsora rectangularitervittata* (Brunner). – Hebard 1929: 78, pl. 5, fig. 6, pl. 6, fig. 1 (male and female); Bruijning 1948: 98; Princis 1969: 954.

*Pseudothyrsocera rectangularitervittata* (Brunner). – Princis, 1969: 956.

Specimens examined. – Borneo. NMWA: 1♂, Grabowsky, coll. Br. v. W. Sarawak. ANSP: Kuching [1°32'N 110°20'E], Sarawak, 1♂ (terminalia slide 454), 9.v.1900, Dyak coll. [all that remains of this specimen is one badly damaged wing, and the terminal abdominal segments in a vial attached to the pin. Hebard's description of the genus apparently was based only on this one specimen, presumably before it was badly damaged. I prepared a slide of the terminal segments and genitalia, see figs. 3, 6.]. HECO: N. Borneo, Kuching, 3♂, 1899, Dyak coll., pres. 1899 by R. Shelford.

Redescription. – Male: Head with interocular width greater than the distance between large round ocellar spots (fig. 1). Pronotum suboval widest behind the middle (fig. 2). Tegmina and wings fully developed extending beyond end of abdomen, the former with simple radial vein and longitudinal discoidal sectors. Hind wing with simple, straight radial vein, medial vein simple, or bifurcate distally, weakly concave, cubitus vein weakly concave with one or two complete and no incomplete branches, apical triangle absent (fig. 8). Front femur Type B<sub>3</sub> with seven or eight long and short stout proximal spines that decrease strongly in length distad succeeded by a short row of five or six piliform spinules terminating in three large spines; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia present. First abdominal tergum with a tuft of setae anteromedially; fifth abdominal tergum with a deep, wide, inverted U-shaped excavation; seventh abdominal segment with a tuft of setae on an anteromedial elevation (fig. 4). [According to Hebard (1929: 78) the male is specialized on abdominal segment one ('median segment') and segments five to seven ('fourth to sixth'). Although the fifth tergum is deeply excavated (fig. 4), there are no setae, depressions, or clear areas on it and I do not consider this segment and the sixth specialized. Only segments one and seven (fig. 4) have a group of medial setae. Supraanal plate symmetrical, with hind margin broadly V-shaped (may be deflexed so that the V is not seen from above), right and left paraprocts small, dissimilar sclerites; medially between the cerci is a membranous shelf, intercercal processes absent (fig. 3). Subgenital plate elongate, strongly convex, at its apex a huge upturned process obliquely to the left, at its apex a small style (figs. 5-7). Genitalia as in fig. 6: hook on the left side, elongate, with a preapical incision; median phallomere divided near the middle, the distal half with a two-pronged asymmetrical structure; right phallomere consisting of three sclerites, one of which is a reduced cleft and another is a plate bearing setae along one margin.

Colour. – Head with occiput and vertex dark



Figs. 9-14. *Pseudothyrsocera xanthophila* (Walker), males. 9-13, from holotype: 9, abdominal terga seven to ten (supraanal plate); 10, hind wing; 11, supraanal plate and paraprocts (ventral); 12, front femur (anterior view); 13, subgenital plate and ninth laterotergites (ventral); 14, subgenital plate (from holotype), and genitalia (from Forsten Belang) (dorsal; arrow indicates the vestigial left style).

brown, remainder brownish yellow, labrum dark (fig. 1). Pronotal disk with a broad, black ring surrounding a yellowish macula, lateral region yellowish, subhyaline (fig. 2). Tegmina brownish-hyaline, anterior margin yellowish. Wings infuscated, darker in the costal region and near the apical margin in both anterior and posterior fields (fig. 8). Abdominal terga brownish with lateral zones brownish yellow, seg-

ments seven to nine darker except for brownish yellow lateral maculae, supraanal plate completely dark (fig. 4). Abdominal sterna brownish yellow. Cerci dorsally with proximal cercomeres dark brown, remaining segments and ventral surface, yellowish. Legs brownish yellow.

Female: Not seen.

Measurements (mm). Length, 9.6-11.0; pronotum

length  $\times$  width,  $2.8\text{--}3.1 \times 3.3\text{--}3.5$ ; tegmen length,  $10.1\text{--}10.5$ ; interocular width  $0.7\text{--}0.8$ .

*Pseudothyrocera xanthophila* (Walker)  
(figs. 9–14)

*Blatta xanthophila* Walker, 1868: 230 (male).

*Thyrocera xanthophila* (Walker). – Kirby 1904: 78.

*Pseudothyrocera xanthophila* (Walker). – Shelford 1906: 250; 1907: 489, pl. 30, figs. 1, 2 (male); 1908a: 5; Princis 1969: 954.

Specimens examined. – Holotype ♂ (terminalia slide 270) of *Blatta xanthophila*, Menado, Celebes, Wallace, W.W. Saunders colln., purchased and pres. '73 by Mrs. F.W. Hope; Type Orth. 51, in HECO. Additional specimens. – Sumatra. NMWA: Sumatra, Deli, Bandar Baroe, 1 ♀, 23.i.22, Fulmek 1921–26, coll. R. Ebner (det. Hanitsch, 1931). RMNH: Belang, Forsten, 1 ♂ (terminalia slide 207) (labelled *xanthophila* by Bruijning).

Redescription. – Male: Head with interocular width slightly greater than the distance between antennal sockets. Pronotum suboval. Tegmina and wings fully developed extending beyond end of abdomen, former with simple radial vein and longitudinal discoidal sectors. Hind wing with straight, simple radial vein, media and cubitus veins weakly curved, former simple, the latter with one to three complete and no incomplete branches, apical triangle absent (fig. 10). Front femur intermediate between Type A, and B, with the row of preterminal spines very short and stout, not piliform-like (fig. 12); pulvilli on four proximal tarsomeres, tarsal claws simple, symmetrical, arolia small. First abdominal tergum unspecialized; hind margin of fifth tergum straight; seventh tergum with a pair of deep fossae separated by a pale medial elevation, setae absent (fig. 9); ninth laterotergites dissimilar, the right one with a spinelike process (fig. 13); supraanal plate produced, the apex narrowly concave with a dark downwardly directed spine in each corner (fig. 11); the spines are not seen in dorsal view, fig. 9); paraprocts dissimilar the left one with one and the right with two spinelike sclerotizations; intercercal processes absent (fig. 11). Subgenital plate narrow, elongate, densely covered with long slender setae on the posterior half, hind margin rounded, left style subobsolete, the right one small spinelike arising within the margin on the dorsal surface (figs. 13, 14; both styles cannot be seen in the pinned specimen which made Shelford conclude that they are absent; his 1907: pl. 30, fig. 2 drawing of the subgenital plate shows an elongated process on the left side of the plate which I did not see in my specimen.). Genitalia as in fig. 14: hook on the left side, with a preapical incision; median phallomere a simple curved rod; right

phallomere consisting of three sclerites one of them a cleft.

Colour. – Yellowish without distinctive markings. Tegmina brownish yellow hyaline. Hind wing with proximal or more portion of anterior field yellowish, remainder darkly infuscated (fig. 10). Cerci yellowish on both surfaces.

Female (previously undescribed): Head with interocular space greater than the distance between antennal sockets. Pronotum suboval. Front femur is distinctly Type B, with four to six stout spines decreasing in length distad, succeeded by seven piliform spinules, terminating in three larger terminal spines [the male front femur is intermediate between Types A and B, with the preterminal spines short and stout which are similar to piliform spinules in length (fig. 12)]. Tegmina and wings fully developed, extending beyond the end of the abdomen, the former with longitudinal sectors. Hind wing with simple radial and media veins, cubitus vein with two complete and no incomplete branches, apical triangle absent. Supraanal plate trigonal, apex rounded. The colouration is yellowish, essentially unicolorous, and similar to the male.

Measurements (mm) (♀ in parentheses). – Length,  $10.0$  ( $9.5$ ); pronotum length  $\times$  width,  $3.2 \times 3.5\text{--}3.7$  ( $3.2 \times 3.7$ ); tegmen length,  $10.0\text{--}11.0$  ( $11.5$ ); interocular width,  $0.9\text{--}1.0$  ( $1.0$ ).

Remarks. – Princis (1969: 954) questioned the Sumatra record of *xanthophila* but the species does occur on that island.

*Pseudothyrocera fulva* Hebard  
(figs. 15–20)

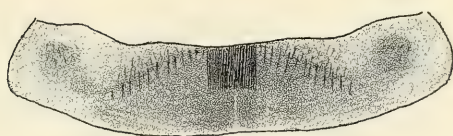
*Pseudothyrocera fulva* Hebard, 1929: 79, pl. 6, fig. 2 (habitus) (female). – Hanitsch 1929a: 269 (incorrectly synonymized with *Pseudothyrocera rubronigra* Hanitsch); 1932a: 64 (incorrectly synonymized with *rubronigra*).

*Pseudothyrocera xanthophila* (nec Walker). – Hanitsch 1929a: 269; Bruijning 1948: 93, fig. 42 [misidentification and incorrectly synonymized *fulva* with *xanthophila* (Walker)].

*Leptothyrocera fulva* (Hebard). – Princis 1965: 152, 1969: 953.

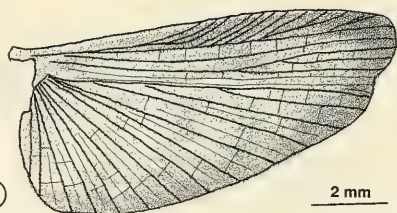
Specimens examined. – Holotype ♀, Fort de Kock [ $0^{\circ}19'S$   $100^{\circ}22'E$ ], Sumatra, 920 m, i.1922, E. Jacobson; Type no, 1147, in ANSP. Additional specimens. – ZMAN: same locality and collector as holotype, 1 ♀, vi.1922, 1 ♂ (terminalia slide 51), 2 ♀ (one labelled *Pseudothyrocera rubronigra* Hanitsch, by Hanitsch), 1924, 1 ♂, 4 ♀, 1925, 2 ♀ (one labelled *Pseudothyrocera xanthophila* Walker, by Hanitsch), 1926. One retained in MCZC. RMNH: Fort de Kock,





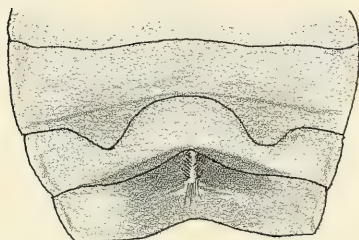
15

1 mm



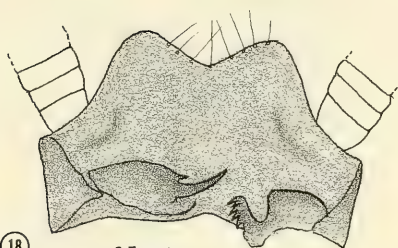
16

2 mm



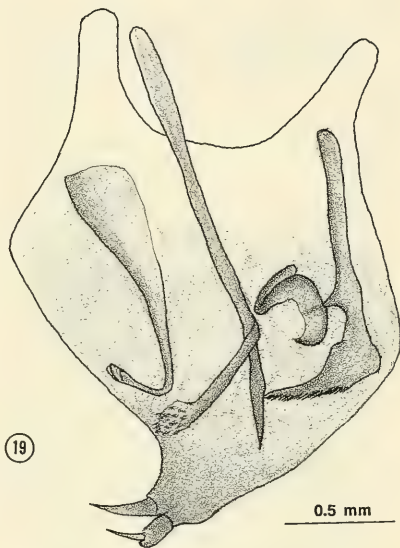
17

1 mm



18

0.5 mm



19

0.5 mm

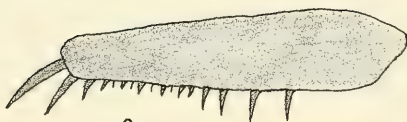


a

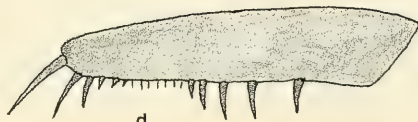


b

1 mm



c



d

Figs. 15-20. *Pseudothyrsocera fulva* Hebard, from Fort de Kock, Sumatra. 15-19, males: 15, first abdominal tergum; 16, hind wing; 17, abdominal terga five to seven; 18, supraanal plate and paraprocts (ventral); 19, subgenital plate and genitalia (dorsal); 20, front femora (anterior views) (a, male, b-d, females).

Sumatra, 920 m, 1♂, 1926, E. Jacobson; 1♂, 1♀, Sumatra Exp., 1877-1878; Suban Ajam, Sum., 1♀, vii.1916; Forsten Belang, 1♂. One retained in MCZC. HECO: Fort de Kock, Sumatra, 920 m, 1♂, 1♀, 1925, 2♀, 1926, E. Jacobson (misidentified as *xanthophila* by Hanitsch).

Redescription. — Male: Head slightly or distinctly exposed, eyes wide apart, interocular space greater than distance between ocellar spots and antennal sockets. Pronotum suboval, widest behind middle. Tegmina and wings fully developed extending beyond end of abdomen, former with longitudinal discoidal sectors. Hind wing with straight, simple, radial vein, media and cubitus veins straight or weakly curved, the latter with one bifurcated or two complete and no incomplete branches, apical triangle absent (fig. 16). Front femur Type B<sub>1</sub> or intermediate between A<sub>1</sub> and B<sub>1</sub>, the large proximal spines decreasing sharply in length so that they become very short stout spines about the same length as the small number of piliform spinules (fig. 20a); pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum with setae on anterior half, these densest anteromedially (fig. 15); fifth abdominal tergum without setal tufts or clear areas (not specialized), hind margin deeply, concavely excavated; sixth segment not specialized, seventh tergum with a pair of depressions anteromedially, separated by a longitudinal ridge bearing setae (fig. 17); supraanal plate with hind margin broadly excavated, paraprocts dissimilar, the right one with a serrated sclerotization, the left one with a spinelike process; intercercal processes absent (fig. 18). Subgenital plate asymmetrical, the apex produced, directed dorsad and bearing a pair of small dissimilar contiguous styles, the right one with a large terminal spine (fig. 19). Genitalia as in fig. 19: hook on the left side, with a preapical incision; median phallomere apically acute, with a distal branch whose apex is spicular; right phallomere consisting of two sclerites, one of them a reduced cleft, distal margin of the other setose.

Female: Front femur Type B<sub>1</sub> (fig. 20d) or B<sub>2</sub>, or intermediate between Types A and B, the large stout proximal spines decreasing sharply in length, these followed by a few minute piliform spinules (some small stout spines about the same length as spinules may occur among the slender spinules; fig. 20c); at least 2 females have no piliform spinules and the short row of spines that precede the 3 terminal spines are stout and about the same length as piliform spinules (Type A; fig. 20b). Supraanal plate symmetrical, rounded, apex reaching slightly beyond margin of subgenital plate.

Colour. — Head, pronotum, cerci, and legs brownish yellow; basal antennal segments brownish yellow, remainder dark brown to black. Tegmina reddish brown-hyaline gradually becoming pale along the anterior margin. Hind wing with yellowish tinge, apex of anterior field and margin of posterior field infuscated. First abdominal segment and terga six to ten dark brown, remainder brownish yellow. The tegmina and dark markings on the abdomen usually are lighter in the female.

Measurements (mm) (♀ in parentheses). — Length, 10.0-11.1 (9.0-11.3); pronotum length × width, 3.1-3.4 × 3.6-3.9 (3.3-3.5 × 3.6-4.1); tegmen length, 10.0-11.6 (10.0-11.6); interocular width, 1.1 (1.2).

Remarks. — Although *rectangularitervittata* and *fulva* have been misidentified, their subgenital plates, styles, and genital phallomeres are distinctly different.

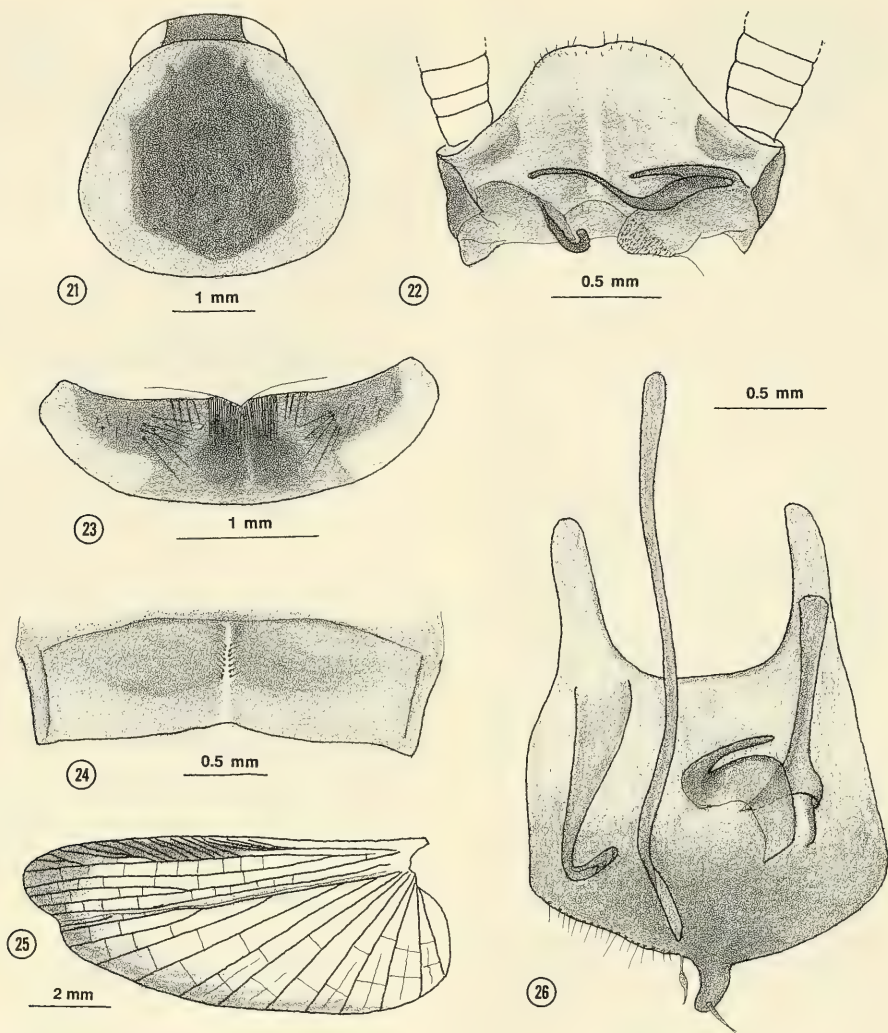
Hanitsch (1929a: 268, 269) reported 11 specimens of *Pseudothyrocera xanthophila* and five examples of *rubronigra* from Fort de Kock (same data as specimens examined here) and stated that the two species differed in colour; because Hebard's *fulva* also came from Fort de Kock, Hanitsch synonymized it with *xanthophila*. Bruijning (1948: 94) accepted Hanitsch's identifications and synonymy stating that the only difference between these two species is colour and concluded that *rubronigra* is a dark morph of *xanthophila* and synonymized the two species. Clearly, *rubronigra* (figs. 27-31) differs from *fulva* (figs. 15-19), as well as *xanthophila* (figs. 9-14) and the three species are distinct. Bruijning's (1948: fig. 42) drawing of the subgenital plate and styles is that of *fulva* and not *xanthophila* as he indicated.

#### *Pseudothyrocera scutigera* (Walker) (figs. 21-26)

*Pseudomops scutigera* Walker, 1868: 212 (male).

*Pseudothyrocera scutigera* (Walker). — Kirby 1904: 77; Shelford 1906: 250, 1907: 489, 1908a: 5; Hanitsch 1915: 34, 1923: 397, 1931: 393; Hebard 1929: 10 (*scutiger*); Bruijning 1948: 95; Princis 1969: 954 (literature).

Specimens examined. — Holotype, ♂ [abdomen missing], Sarawak, Wallace in Mr. Saunders collection; Type Orth. 52 in HECO. Additional specimens. — Sabah. ZILS: Malaysia, Sabah, Sipitang [5°05'N 115°33'E] Mendolong, 1♂, 8.xii.1987, T1B/W/4, 1♂ (terminalia slide 423), 25.iv.1988, 1♂, 11.v.1988, 1♂, 14.iii.1988, S. Adebratt. One retained in MCZC. Unknown country. RMNH: Orut Ratuna, 1♂, v.1865, Van Hasselt (reported by Bruijning, 1948: 95).

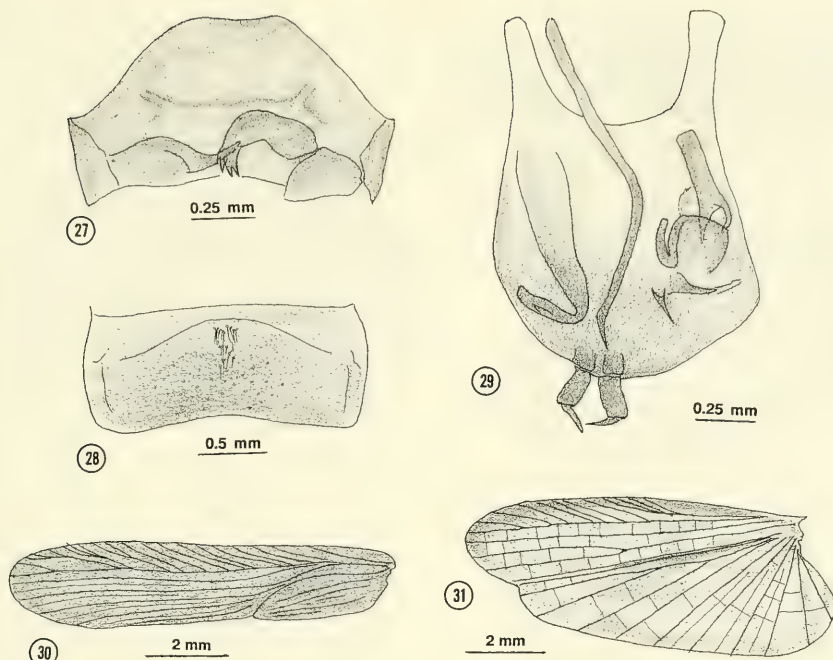


Figs. 21-26. *Pseudothyrocera scutigera* (Walker), males from Sabah: 21, pronotum; 22, supraanal plate and paraprocts (ventral); 23, first abdominal tergum; 24, seventh abdominal tergum; 25, hind wing; 26, subgenital plate and genitalia (dorsal).

Redescription. – Male: Head exposed, interocular width slightly greater than distance between ocellar spots. Antennae not plumose. Pronotum suboval, sides deflexed, widest behind middle (fig. 21). Tegmina and wings fully developed extending beyond end of abdomen, former with longitudinal discoidal sectors. Hind wing radial and media veins simple, straight, cubitus straight with a single complete and no incomplete branches, apical triangle

absent (fig. 25). Front femur Type B, with four or five large or stout proximal spines; pulvilli on four proximal tarsomeres, tarsal claws simple, symmetrical, arolia well developed. First abdominal tergum specialized with setal groups anteromedially, the densest in a raised middle region (fig. 23). Seventh abdominal tergum with a pair of shallow depressions separated by a longitudinal ridge bearing two rows of setae (fig. 24). Supraanal plate with sides of hind margin oblique,





Figs. 27-31. *Pseudothyrocera rubronigra* (Hanitsch), male lectotype. 27, supraanal plate and paraprocts (ventral); 28, seventh abdominal tergum; 29, subgenital plate and genitalia (dorsal); 30, left tegmen; 31, left hind wing.

apical region rounded, weakly indented medially; paraprocts dissimilar, left one with a small hooklike sclerotization, right one with two dissimilar spinelike sclerotizations; intercercal processes absent (fig. 22). Subgenital plate practically symmetrical, hind margin with a rounded protruding structure medially, which may represent a nonarticulated style bearing a minute apical seta; to the left of this structure is a long slender seta or one that is swollen medially (fig. 26). Genitalia as in fig. 26: hook on the left side with a preapical incision; median phallomere slender, simple; right phallomere consisting of two sclerites of which one is a cleft.

Female: Unknown.

Colour. – Head black, labrum lighter, maxillary palpomeres one to three and basal half of the fourth pale, remainder black; antennae with about the first 30 antennomeres black succeeded by about 30 white segments, remainder black. Pronotum with a large black macula surrounded by yellow (fig. 21); mesonotum dark, metanotum yellow. Tegmina with part of anterior region reddish, remainder black. First abdominal tergum black except for yellow lateral

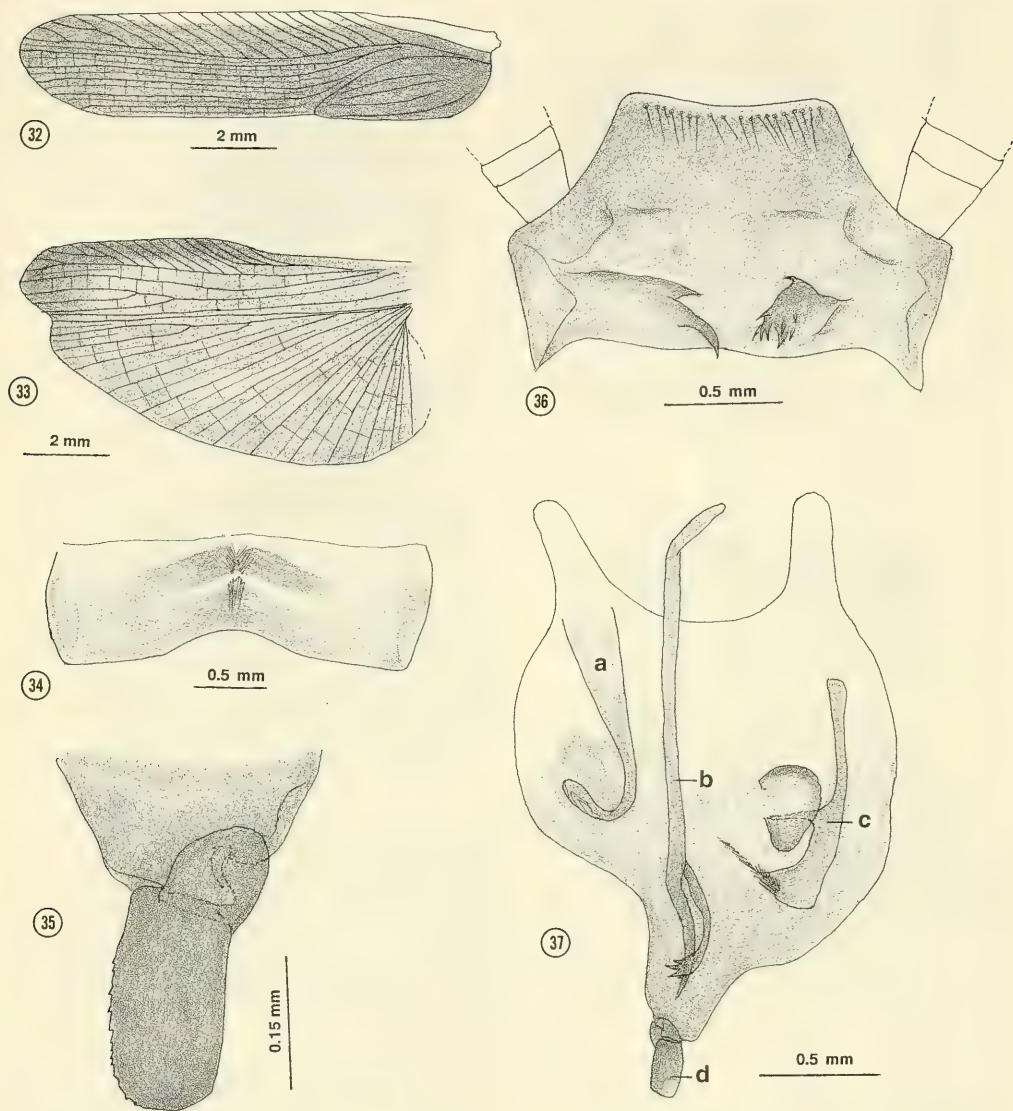
zones, segments two to five yellow, the sixth black except for yellow lateral areas, seven to ten black except for pale apex on supraanal plate. Abdominal sternae yellow, subgenital plate dark. Front coxae black on basal half, rest white, mid and hind coxae mostly black their distal parts and outer margins, and trochanters white, femora, tibiae and tarsi dark reddish brown. Cerci white, their proximal segments with yellowish tinge.

Measurements (mm) (the holotype is smaller than the others and is shown in parentheses). – Length, 8.6-10.5 (abdomen missing); pronotum length  $\times$  width, 2.8-3.0  $\times$  3.1-3.2 (2.5  $\times$  2.8); tegmen length, 10.6-11.2 (10.0); interocular width, 0.9-1.0 (0.8).

Remarks. – The distinctive colour markings (particularly the pronotal macula) separates this species from others in the genus.

*Pseudothyrocera rubronigra* (Hanitsch)  
(figs. 27-31)

*Phyllodromia rubro-nigra* Hanitsch, 1923: 412, fig. 11 only, (male only, not female). – Bruijning 1948: 93 (incorrectly synonymized with *xanthophila*).



Figs. 32-37. *Pseudothyrsocera perkinsi* sp. n., male holotype: 32, left tegmen; 33, left hind wing. 34, seventh abdominal tergum; 35, single style at the apex of the subgenital plate (ventral); 36, supraanal plate and paraprocts (ventral); 37, subgenital plate and genitalia (dorsal; a, left phallomere; b, median phallomere; c, sclerites of the right phallomere; d, style).

*Pseudothyrsocera rubro-nigra* (Hanitsch). – Hanitsch 1928: 14, 1929a: 269, 1932a: 64; Hebard 1929: 10 (exclusive of '♀').

*Pseudothyrsocera fulva* (nec Hebard). – Hanitsch 1929a: 269 (misidentification).

*Mopserina rubronigra* (Hanitsch). – Princis 1965: 152 (exclusive of '♀').

*Hemithyrsocera rubronigra* (Hanitsch). – Princis 1971: 1127 (literature, exclusive of '♀').

Specimens examined. – Lectotype ♂ (selected by Hebard 1929: 79) (terminalia slide 267), Gunong Angsi, Negri Sembilan, Malaya, [2°45'N 102°10'E] 2000'-2790', iv.1918, Hanitsch; Type Orth. 263 $\frac{1}{3}$ , in HECO. Additional specimens. – Malaya. HECO: same data as lectotype, 1 ♂, Type Orth. 263 $\frac{1}{3}$  (see remarks, below).

Redescription. – Male: Head exposed, eyes bulbous, somewhat reduced, interocular space greater than the distance between antennal sockets and ocellar spots; proximal antennal segments weakly plumose. Pronotum suboval. Tegmina and wings fully developed extending beyond end of abdomen, the former narrow with longitudinal discoidal sectors (fig. 30). Hind wing with simple, thickened costal veins, media and radial veins straight, simple, cubitus vein straight, with one long complete and no incomplete branches, apical triangle absent (fig. 31). Anteroventral margin of front femur Type B<sub>1</sub>, with five to seven large proximal spines; pulvilli on four proximal tarsomeres, tarsal claws simple, symmetrical, arolia small. First abdominal tergum unspecialized. Seventh abdominal tergum with a small group of setae anteromedially (fig. 28). Supraanal plate hind margin with oblique sides and broadly subtruncate apex, right and left paraprocts dissimilar, intercercal processes absent (fig. 27). Subgenital plate weakly asymmetrical with a pair of similar, almost contiguous styli mesad on the hind margin; each style consists of a small base arising within the margin of the plate succeeded by a rectangular segment and terminating in an articulated spine (fig. 29). Genitalia as in fig. 29: hook on the left side, with a preapical incision, median phallomere, slender, simple, apex acute, right phallomere consisting of two sclerites one of which is a cleft, and near it are two small spines.

Colour. – Head orangish, unicolourous, maxillary palpomeres dark brown, proximal antennal segments and apex blackish, remainder yellowish. Pronotum orangish without markings. Tegmina dark reddish brown-hyaline, veins very dark. Hind wing weakly infuscated, anterior region and apex of anterior field darker (fig. 31). Abdominal terga light brown, terminal segments darker. Abdominal sterna light brown, subgenital plate darker. Coxae and femora orangish, the latter apically dark, tibiae and tarsi blackish brown. Cerci yellowish white.

Female. Unknown.

Measurements (mm). – Length, 7.8; pronotum length  $\times$  width, 2.2–2.3  $\times$  2.6; tegmen length, 9.4–9.5; interocular width, 1.0–1.1.

Remarks. – Hanitsch (1923) reported only two syntypes, one male and one female, in his original description. These two specimens have handwritten species labels. The 'female' actually is a male and is a new species described below as *perkinsi*. There is a third male (listed above as additional specimens) labelled Type Orth. 263<sup>1</sup>/<sub>1</sub>; it has the same data as the lectotype and is clearly *rubronigra* but is not a syntype and does not have a handwritten identification label.

Hanitsch noted that the '♀' of *rubronigra* was large

er and the shape of the pronotum differed from the male but he considered them to be the same species. Hebard (1929: 79) disagreed and correctly stated that the two sexes were different species. Princis (1965: 152) actually examined the 'Typen (♂ ♀)' of *rubronigra* and concluded that they belonged to the same species, were not related to '*Pseudothyrsocera*' *fulva* Hebard and placed it in *Mopserina* Princis which he later (1971: 1124) synonymized with *Hemithyrsocera*, and incorrectly listed (p. 1127) *rubronigra* under that genus.

*Pseudothyrsocera perkinsi* sp. n.  
(figs. 32–37)

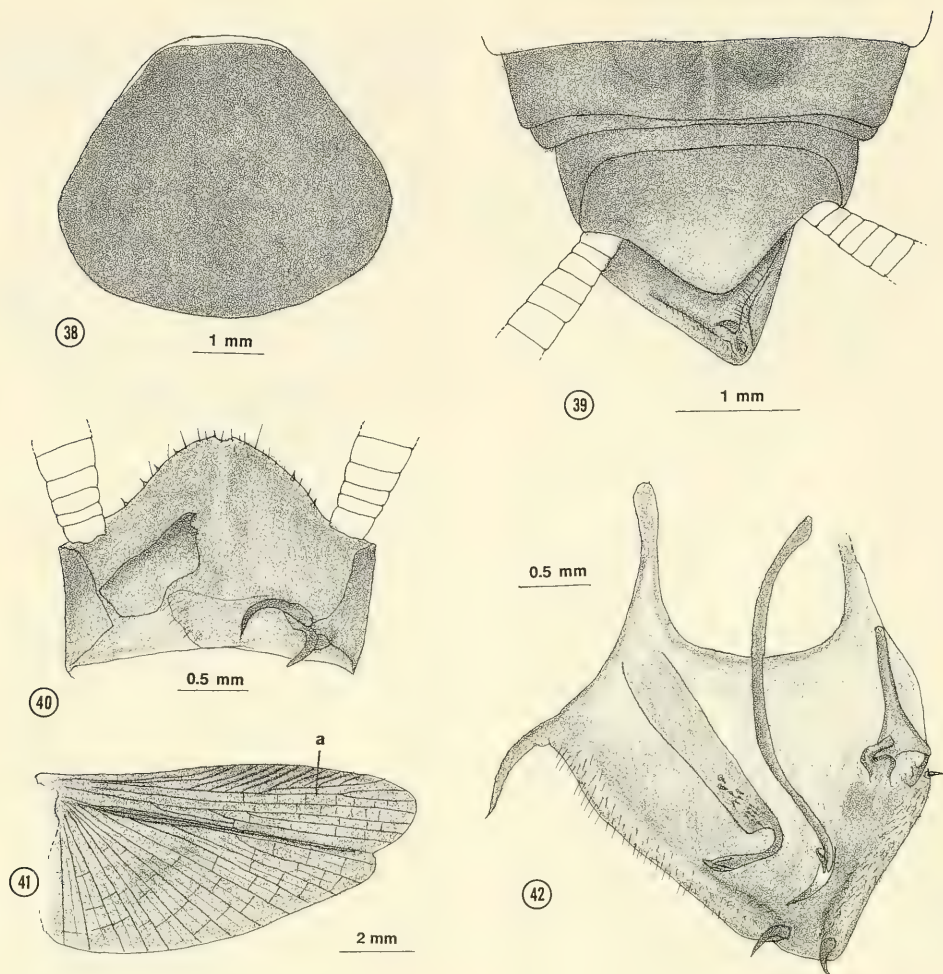
*Phyllodromia rubro-nigra* Hanitsch (in part, 'paralectotype' male, incorrectly determined as '♀'), 1923: 412, fig. 12 only.

Specimen examined. – ♂ holotype (terminalia slide 268), Gunung Angsi, Negri Sembilan, Malaya, [2°45'N 102°10'E] 2000'–2790', iv. 1918, Hanitsch ('Type Orth. 263<sup>1</sup>/<sub>1</sub>' of *Phyllodromia rubro-nigra* Hanitsch, ♂, not ♀ as indicated); in HECO.

Description. – Male: Head almost completely hidden, eyes bulbous, somewhat reduced, wide apart, interocular space greater than the space between ocellar spots and antennal sockets; antennae missing. Pronotum suboval. Tegmina and wings fully developed, the former narrow with longitudinal discoidal sectors (fig. 32). Hind wing with thickened costal veins, all but the preterminal one simple; radial vein simple, media curved, cubitus vein curved with two complete and no incomplete branches, apical triangle absent (fig. 33). Front femur Type B<sub>1</sub>, with six large proximal spines; pulvilli on four proximal tarsomeres, tarsal claws simple, symmetrical, arolia small. First abdominal segment unspecialized. Seventh abdominal tergum with two small groups of setae medially (fig. 34). Supraanal plate subtrapezoidal, paraprocts dissimilar, the right one terminating in several small spines, intercercal processes absent (fig. 36). Subgenital plate distinctly asymmetrical, the distal half of the left margin excavated, with a single large style at the apex (figs. 35, 37). Genitalia as in fig. 37: hook on the left side, with a preapical incision; median phallomere slender with a distal branch that terminates in several small spines; right phallomere consisting of two sclerites one of which terminates in a narrow row of minute setae.

Colour. – Head and pronotum unicolourous, orangish; maxillary palpomeres three and four pale, terminal segment light brown. Tegmina blackish with a narrow orangish stripe along most of the anterior margin (fig. 32). Wings darkly infuscated, anterior and apical regions darker (fig. 33).





Figs. 38-42. *Pseudothyrsocera rufiventris* (Stål), male from Surigao, Mindanao, Philippine Islands: 38, pronotum (the very narrow yellow anterior margin is asymmetrical and is missing on the right side); 39, abdominal terga seven to ten and subgenital plate (dorsal); 40, supraanal plate and paraprocts (ventral); 41, hind wing (a, pseudobranch of the radial vein); 42, subgenital plate and genitalia (dorsal).

Female: Unknown.

Measurements (mm). – Pronotum length  $\times$  width, 3.3-3.7; regmen length, 11.3; interocular width, 1.1.

Etymology. – The species is dedicated to my friend Dr. Philip Perkins, Collection Manager, Entomology Department, Museum of Comparative Zoology, Harvard University.

Remarks. – See above remarks under *rubronigra*.

The single huge style at the apex of the subgenital plate is unique for the genus.

*lugubris*-species-group

*Pseudothyrsocera rufiventris* (Stål)  
(figs. 38-42)

*Thyrsocera rufiventris* Stål, 1877: 33 (male). – Sjöstedt 1933: 3.

*Hemithyrlocera rufiventris* (Stål). – Kirby 1904: 77.  
*Pseudothyrlocera rufiventris* (Stål). – Shelford 1908a, 5;  
 1908b: 469; Princis 1969: 956 [listed as a synonym of *P.*  
*signata* (Brunner); see remarks, below].

Specimens examined. – Lectotype, ♂ (here designated; with an unpublished lectotype label written by Princis, 1968), Ins. Philipp., in NRSS. Philippine Islands. ANSP: Surigao [9°45'N 125°30'E], Mindanao, 2♂ (one labelled *Pseudothyrlocera lugubris* (Stål) by Hebard, 1928) (one with terminalia slide 455); N.W. Panay [7°20'N 124°14'E], 1♂, Baker (labelled *Pseudothyrlocera rufiventris* (Stål) by Hebard, 1928).

Redescription. – Male: Head exposed, interocular distance greater than the distances between ocellar spots and antennal sockets; antennae not plumose. Pronotum suboval, widest behind the middle (fig. 38). Tegmina and wings fully developed, narrow, extending beyond end of abdomen, the former with simple, straight radial vein and longitudinal discoidal sectors. Hind wing with radial and media veins simple, straight, cubitus vein straight with two complete and one long incomplete branch, apical triangle absent (fig. 41). Front femur Type B<sub>1</sub> with four large proximal spines; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum unspecialized. Seventh abdominal tergum with a pair of shallow medial depressions with minute spaced setae (which may be white), setal groups absent; the depressions are separated by a longitudinal ridge (fig. 39) and there is a clear membranous zone in the anterior part of the ridge which is hidden by the overlapping sixth tergum in the pinned specimen. Supraanal plate symmetrical, trigonal, apex shallowly notched; paraprocts dissimilar darkly sclerotized, the right one with two spinelike processes, intercercal processes absent (fig. 40). Subgenital plate convex, trigonal, the sides upturned, asymmetrical, with a large spinelike process about midway on the left margin and a small dark seta on the opposite side; a pair of small similar styles occur apically on the dorsal surface within the margin (not visible in ventral view) (figs. 39, 42). Genitalia as in fig. 42: hook phallomere large, on the left side with a preapical incision and three groups of setae on the shaft just before the curved region; median phallomere with a small acute sclerite apically; right phallomere consisting of two sclerites one of which is a reduced cleft.

Colour. – Very dark. Head with reddish eyes, ocellar spots yellowish, antennae and maxillary palpi black, clypeus and labrum somewhat lighter. Pronotum usually solidly black or with a narrow incomplete yellowish line along the anterior margin (fig. 38). Tegmina black with a hyaline spot (very indistinct in lectotype) in the subcostal area. Hind

wings very dark brown. Abdominal terga black, supraanal plate dark reddish brown or black. Abdominal sterna reddish, apex of subgenital plate with a dark blotch. Legs black, outer margins of coxae yellow. Cerci black.

Female: Not seen.

Measurements (mm). – Length, 12.0–14.5; pronotum length  $\times$  width, 3.6–4.1  $\times$  4.2–4.7; tegmen length, 12.0–14.5; interocular width, 1.0–1.1.

Remarks. – Shelford (1908a: 5) listed *P. semicincta* as a synonym of *rufiventris*, and Princis (1969: 956) listed *rufiventris* as a synonym of *P. signata*. However, the pronotum of *rufiventris* is virtually all dark except for a subobsolete pale anterior margin (fig. 38); the pronotum of *signata* (= *semicincta*) is shiny black with yellow very narrow on the anterior, and lateral margins (may be absent), and broad posteriorly (figs. 57, 59). Until the male of *signata* is found and compared with *rufiventris*, I am listing them separately.

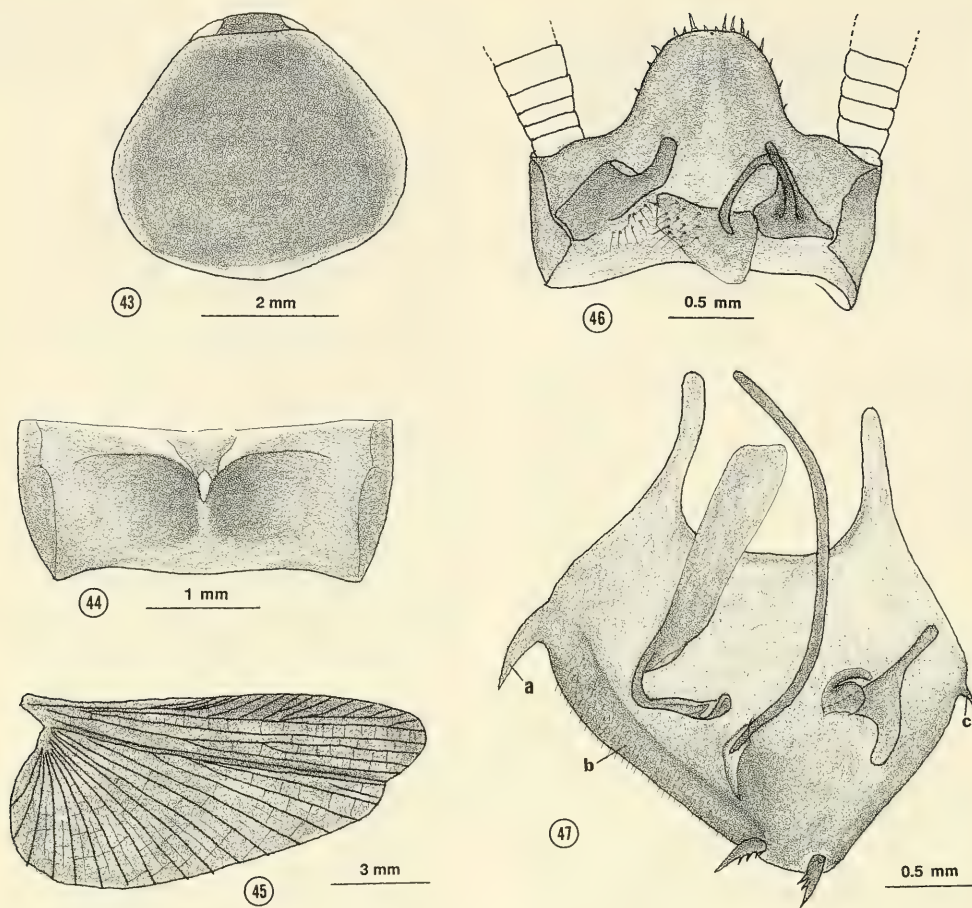
The male subgenital plate, styles, and genitalia of *rufiventris* (fig. 42), *lugubris* (fig. 47) and *circumcincta* (fig. 49) are very similar. These taxa can be separated by the differences in the pronotal markings and the shapes of the supraanal plates (cf. figs. 39, 46, 50).

#### *Pseudothyrlocera lugubris* (Stål) (figs. 43–47)

*Thyrlocera lugubris* Stål, 1877: 33 (male). – Sjöstedt 1933: 3.  
*Hemithyrlocera lugubris* (Stål). – Kirby 1904: 77.  
*Pseudothyrlocera lugubris* (Stål). – Shelford 1908a: 5; Princis 1969: 955 (literature exclusive of synonymy).

Specimens examined. – Lectotype, ♂ (here designated; with an unpublished lectotype label written by Princis 1968), no exact locality, Ins. Philipp. [Philippine Islands], Semper; in NRSS. – Paralectotypes. Philippine Islands. NRSS: same data as lectotype, 3♂ (1 with terminalia slide 72).

Redescription. – Male: Head with interocular space slightly greater than distance between ocelliform spots and antennal sockets; antennae not plumose. Pronotum suboval, widest behind middle (fig. 43). Tegmina and wings fully developed extending beyond end of abdomen, former with longitudinal discoidal sectors. Hind wing with simple, straight radial and media veins, cubitus vein straight with two long complete and no incomplete branches, apical triangle absent (fig. 45). Front femur Type B<sub>1</sub> with three large proximal spines, or with an additional one or two small spines; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia present. First abdominal tergum unspecialized. Seventh abdominal tergum with a pair of nonsetose depres-



Figs. 43-47. *Pseudothyrsocera lugubris* (Stål), males from the Philippines: 43, lectotype, pronotum; 44-47, paralectotype: 44, seventh abdominal tergum; 45, hind wing; 46, supraanal plate and paraprocts (ventral); 47, subgenital plate and genitalia (dorsal); a, spinelike process on the left side; b, thickened left margin; c, small spinelike process on the right side).

sions separated by a longitudinal ridge; a narrow clear zone anteromedially is seen in a slide preparation but is hidden by the overlapping sixth segment in the pinned specimen (fig. 44). Supraanal plate with median portion roundly produced or with a shallow medial indentation (visible in pinned specimens), the hind margin with some small spines, right and left paraprocts dissimilar, intercercal processes absent (fig. 46). Subgenital plate asymmetrical, trigonal, the left side with a large spinelike process and a broad roundly thickened border covered with fine setae, the right margin with a minute spinelike process; a pair of similar closely spaced serrated styli located at apex of plate (fig. 47). Genitalia as in fig. 47: elongated geni-

tal hook on left side with a preapical incision; median phallomere a curved rod with an acute membrane enclosing the apex; right phallomere consisting of two small sclerites, one a cleft.

Colour. — Head black, clypeus lighter, genae and ocelliform spots yellow; antennae and maxillary palpi black. Pronotum completely black or with a narrow yellowish band along posterior margin and indistinct dull reddish narrow band around the remaining margin (lectotype) (fig. 43), or dull reddish on hind margin only. Tegmina reddish brown or black with a yellowish-hyaline mark on distal half of subcostal region. Hind wings dark brown. Abdominal terga dark reddish brown or black. Abdominal sterna red-



dish, subgenital plate dark brownish. Legs black, coxae with outer margin yellow. Cerci black.

Female: Not seen.

Measurements (mm). – Length, 11.5–14.0; pronotum length  $\times$  width, 3.3–4.0  $\times$  3.9–4.5; tegmen length, 12.0–14.0; interocular width, 1.0–1.1.

Remarks. – The species is closest to *rufiventris* (see remarks under that species).

*Pseudothyrocera circumcincta* (Stål)  
(figs. 48–52)

*Thyrocera circumcincta* Stål, 1877: 33 (male). – Kirby 1904: 77 (synonymized under *signata*); Shelford 1908a: 5, 1908b: 469; Sjöstedt, 1933: 3.

*Pseudothyrocera circumcincta* (Stål). – Shelford 1908a: 5; 1908b: 469; Princis 1969: 955 (listed as a synonym of *lugubris*).

Specimens examined. – Philippine Islands. NRSS: Holotype ♂ (terminalia slide 73), of *Thyrocera circumcincta* Stål, Ins. Philipp., no exact locality, Semper [Princis wrote '*Pseudothyrocera lugubris* (Stål), K. Princis, 1968' on back of holotype label]; same data as holotype, 1 ♀ (with handwritten label, '... = *circumcincta*, teste Shelford'). ANSP: Imugan [16°12'N 120°52'E], Luzon, 1 ♀ [labelled *Pseudothyrocera circumclusa* (Stål) ♀, by Hebard 1928].

Redescription. – Male: Head exposed, interocular width greater than space between ocellar spots and antennal sockets; antennae not plumose. Pronotum suboval, widest behind middle (fig. 48). Tegmina and wings fully developed, discoidal sectors of former longitudinal. Hind wing with radial and medial veins simple, straight, cubitus vein straight with two long complete and no incomplete branches, apical triangle absent (similar to fig. 45). Front femur Type B, with four long or three long and three short stout spines; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum unspecialized. Seventh abdominal tergum with a pair of shallow depressions separated by a longitudinal nonsetose ridge (similar to fig. 44). Supraanal plate medially broadly produced, the rounded hind margin with a dense row of small uniform spines, paraprocts dissimilar, intercercal processes absent (fig. 50). Subgenital plate trigonal, with a spinelike process midway on the left side, the margin posterior to it thickened and covered with small setae; right and left styles similar, spinelike (fig. 49). Genitalia as in fig. 49: hook on the left side with a preapical incision; median phallomere a slender rod; right phallomere consisting of two sclerites one of them a reduced cleft.

Colour. – Head black, genae and ocellar spots white; maxillary palpi and antennae black. Pronotum black, completely surrounded by a broad yellow band (fig. 48). Tegmina light reddish brown-hyaline, subcostal region lighter. Abdominal terga and sterna orangish. Cerci dark brown. Legs dark reddish brown, outer margins of coxae, and trochanters pale.

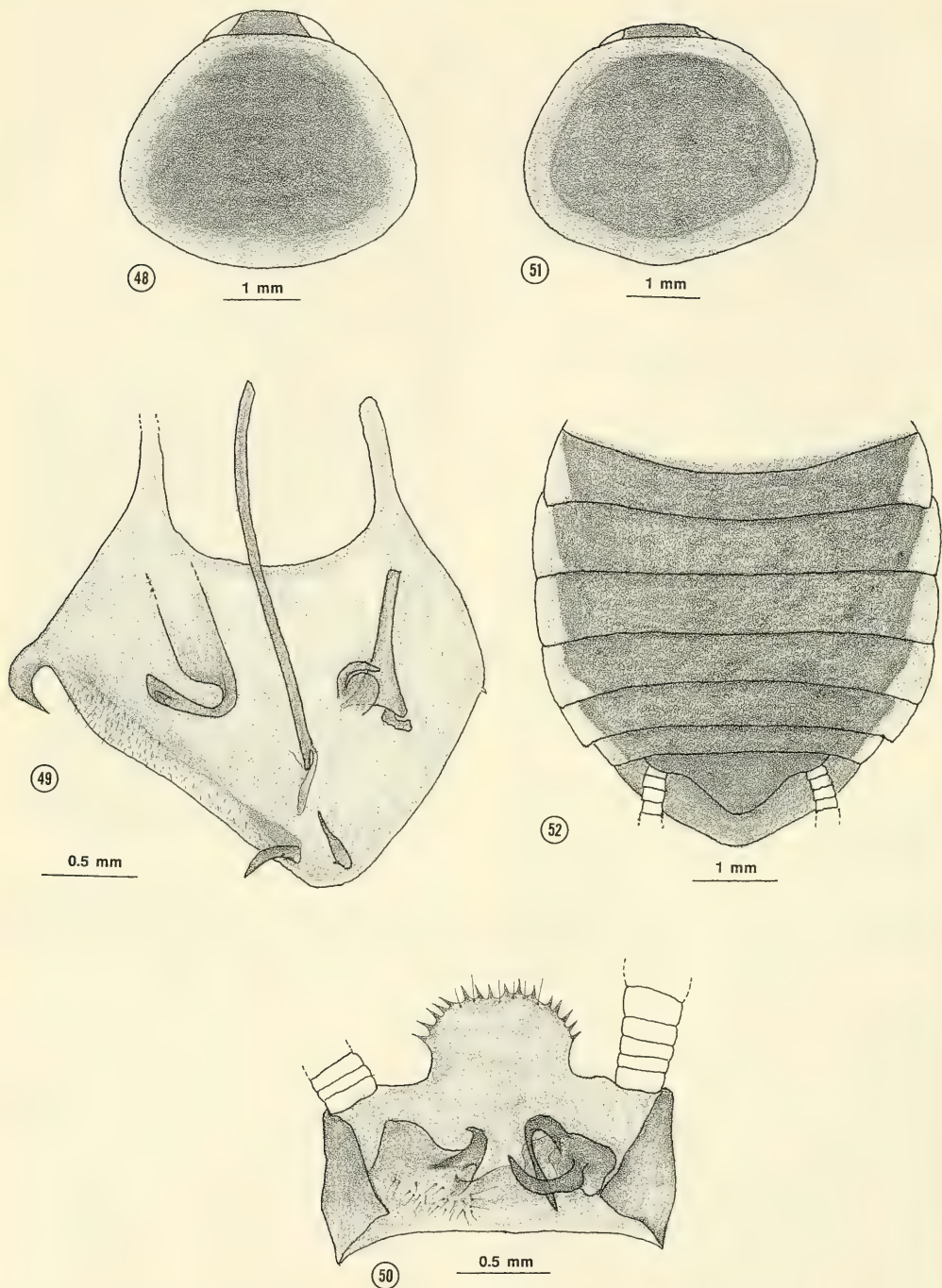
Female: Head slightly exposed, interocular width greater than space between ocelliform spots; antennae not plumose. Pronotum suboval (fig. 51). Tegmina and wings fully developed extending beyond end of abdomen, former with longitudinal discoidal sectors. Hind wing with straight, simple, radial and media veins, cubitus vein straight with two long complete branches, apical triangle absent. Front femur Type B, with four large proximal spines, tarsal claws simple, symmetrical, arolia present. Supraanal plate broadly trigonal, apex rounded (fig. 52).

Colour. – Head black, ocelliform spots and genae yellow, maxillary palpi and antennae black. Pronotum black completely surrounded by a broad yellow margin (fig. 51). Tegmina dark reddish brown, subcostal region yellow-hyaline. Wings dark brownish. Abdominal terga black with triangular yellow marks on the posterolateral corners of segments two to seven or two to six, supraanal plate completely dark (fig. 52). Abdominal sterna black, lateral and hind margins yellowish, basal half of subgenital plate dark, distal half reddish. Legs black, outer margins of coxae yellow.

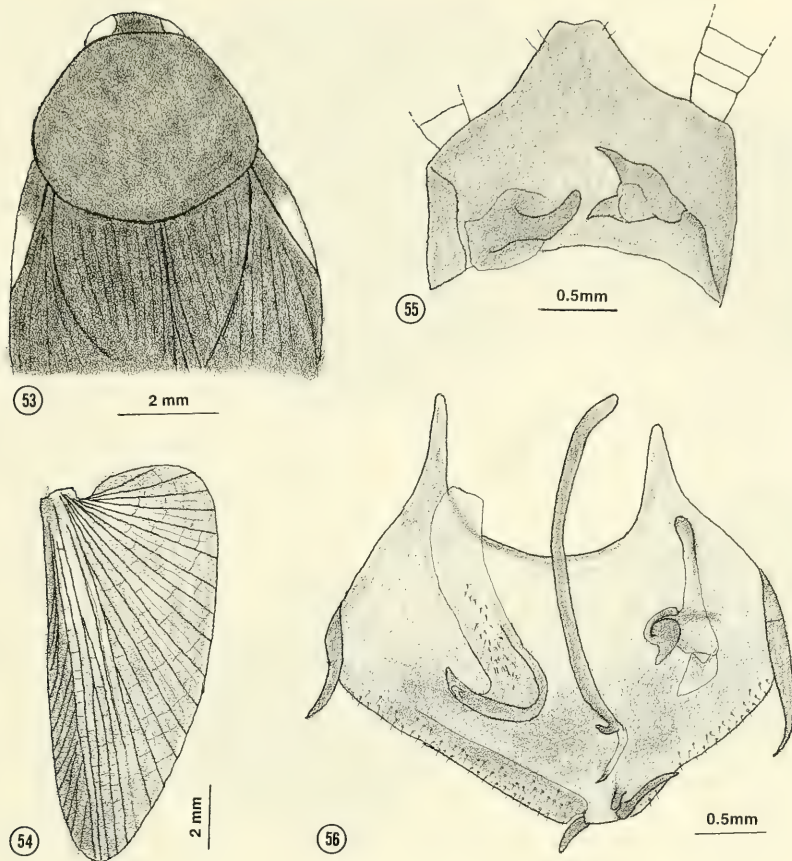
Measurements (mm) (♀ in parentheses). – Length, 10.0 (10.5–13.4); pronotum length  $\times$  width, 3.1  $\times$  4.0 (3.4–3.8  $\times$  4.3–4.5); tegmen length, 10.5 (10.0–11.7); interocular width, 0.9 (1.1).

Remarks. – *Pseudothyrocera circumcincta* is clearly closely related to *lugubris* because of the similarities of their subgenital plates. Princis (1969: 955) considered the former to be a synonym of the latter. However, there is a distinct difference between their sizes and supraanal plates; also their colours are strikingly different and I prefer to treat them as distinct taxa until additional specimens are studied to show the extent of variation.

Kirby (1904: 77) synonymized *P. circumcincta* (Stål) with *signata* but I am treating them separately. Unfortunately, the latter was based on females only. Brunner incorrectly described the posterolateral corners of the first five abdominal terga as having triangular yellow spots whereas the *signata* holotype has yellow lateral corners on segments three to five (as in *semicincta*, fig. 58). The two females that I have determined as *circumcincta* have a black abdomen with yellow posterolateral corners on terga two to seven (fig. 52), or two to six.



Figs. 48-52. *Pseudothyrocera circumcincta* (Stål). 48-50, male holotype: 48, pronotum; 49, subgenital plate and genitalia (dorsal); 50, supraanal plate and paraprocts (ventral); 51, 52, female from Imugan, Luzon, Philippine Islands: 51, pronotum; 52, abdomen (dorsal) (first tergum not shown).



Figs. 53-56. *Pseudothyrsocera montana* (Shelford), males from Kuching, Sarawak. 53, lectotype, pronotum and proximal region of the tegmina; 54-56, paralectotype: 54, hind wing; 55, supraanal plate and paraprocts (ventral); 56, subgenital plate and genitalia (dorsal).

*Pseudothyrsocera montana* Shelford  
(figs. 53-56)

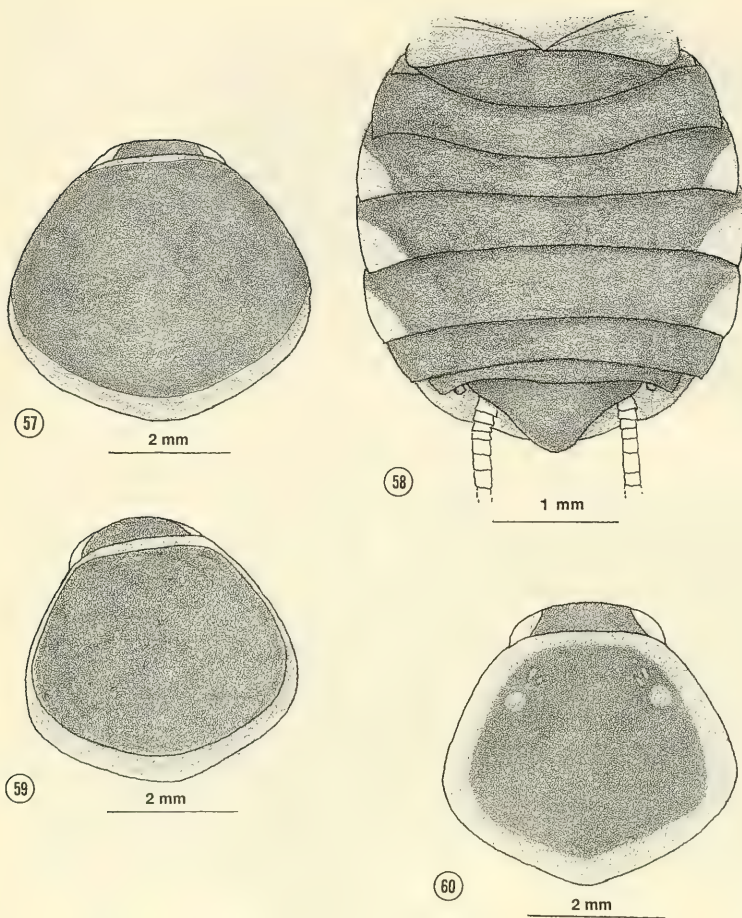
*Pseudothyrsocera montana* Shelford, 1906: 251 (male). — Shelford 1908a: 5; Hanitsch 1915: 35, 1923: 463; Hebard 1929: 10; Bruijning 1948: 95.

Specimens examined. — Lectotype (here designated), ♂, Mt. Matanga, nr. Kuching, N.W. Borneo [Sarawak], about 3000', vi.1900, pres. 1906 by the Sarawak Museum; Type Orth. 49½ in HECO. Paralectotype. Sarawak. HECO: 1 ♂ (terminalia slide 299), same data as lectotype, Type Orth. 49½.

Redescription. — Male: Head with vertex exposed, interocular space greater than the distance between antennal sockets; antennae slightly thickened, not

plumose. Pronotum suboval (fig. 53). Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal discoidal sectors. Hind wing with simple radial and media veins, cubitus vein with two complete and no (left wing) or one (right wing) incomplete branches (paralectotype), apical triangle absent (fig. 54). Front femur Type B<sub>3</sub> with seven stout proximal spines; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia present. First abdominal tergum with a group of setae anteromedially. Seventh abdominal terga with a pair of shallow fossae containing symmetrically spaced small setae (seen in slide preparation). Supraanal plate trigonal, sides weakly concave, apex slightly indented, intercercal processes absent, right and left paraprocts with dissimilar spinelike





Figs. 57-60. *Pseudothyrocera* spp. 57-59, *P. signata* (Brunner): 57-58, female lectotype of *Thyrocera semicincta* Stål, pronotum, and abdomen; 59, female holotype of *P. signata*, pronotum. 60, *P. circumclusa* (Stål), female lectotype, pronotum.

processes (fig. 55). Subgenital plate asymmetrical, the posterior half trigonal (that portion visible in the pinned specimen), left side roundly thickened, with an elongated process near the middle of the lateral margins, the one on the right side larger; a pair of narrowly separated dissimilar spinelike styles, the right one slightly longer, are located at the apex of the plate (fig. 56; Shelford did not see the right style which was upturned and hidden in the pinned specimen, and he incorrectly stated that there is only one style). Genitalia as in fig. 56: hook on the left side, very large, apex with a preapical incision; median phallosome a curved rod with a very small preterminal process; right phallosome consisting of three sclerites one of them a small cleft.

Female: Unknown.

Colour. – Head, maxillary palpi, antennae, pronotum, meso-, metanotum, and abdominal terga black. Tegmina black with a yellowish spot on the distal half

of the subcostal field (fig. 53).

Hind wings infuscated (fig. 54). Abdominal sterna, coxae and femora reddish; cerci and apices of femora, tibiae, and tarsi, black.

Measurements (mm). Length, 11.5; pronotum length  $\times$  width, 4.4  $\times$  5.4; tegmen length, 14.2; interocular width, 1.4.

*Pseudothyrocera signata* (Brunner)  
(figs. 57-59)

- Thyrocera signata* Brunner, 1865: 119 (female).  
*Pseudomops signata* (Brunner). – Walker 1869: 135.  
*Hemithyrocera signata* (Brunner). – Kirby 1904: 77.  
*Pseudothyrocera signata* (Brunner). – Shelford 1908a: 5.  
*Thyrocera semicincta* Stål, 1877: 33 (female). – Sjöstedt 1933: 3.  
*Hemithyrocera semicincta* (Stål). – Kirby 1904: 77.  
*Pseudothyrocera semicincta* (Stål). – Princis 1969: 956 (listed as a synonym of *signata*).

Specimens examined. – Holotype ♀ of *Thyrsocera signata* Brunner, Philippines (no exact locality), Thorey, coll. Br. v. W.; in NMWA. Lectotype (here designated; with an unpublished lectotype label written by Princis, 1968), ♀ of *P. semicincta*, Ins. Philipp., no exact locality (Philippine Islands) (with Princis's handwritten '*Pseudophoraspis rufiventris* (Stål), K. Princis, 1968' on back of his 'lectotype' label); in NRSS. Paralectotype. NRSS: same data as lectotype, 1 ♀ (with handwritten label, *rufiventris*, teste Shelford). Additional specimens. – ANSP: no exact locality, 1 ♀, Acc. No. 11998, Bu. of Sci., P.I. (det. as *semicincta* by Hebard 1928).

Redescription. – Female: Head slightly exposed, interocular width greater than distance between ocellar spots and antennal sockets; antennae not plumose. Pronotum suboval (fig. 57). Tegmina and wings fully developed extending beyond end of abdomen, discoidal sectors of former longitudinal. Hind wing with radial and media veins straight, simple, cubitus vein straight with two long complete and no incomplete branches, apical triangle absent. Front femur Type B, with three or four large proximal spines; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia present. Supraanal plate trigonal, apex rounded.

Colour. – Head black, genae black; maxillary palpi and antennae black. Pronotum black with a narrow yellow band on anterior margin and on posterior and distal parts of lateral margins (fig. 57, 59). Tegmina black with a yellowish-hyaline mark on distal half of subcostal zone. Hind wing black-hyaline. Abdominal terga black with a large triangular yellow macula in posterolateral corners of segments three to five (fig. 58). Abdominal sterna reddish, or reddish with brown areas medially on proximal half or more. Legs black or brownish black, coxae with yellowish white outer margins. Cerci black.

Male: Unknown.

Measurements (mm). – Length, 13.0–14.0; pronotum length  $\times$  width, 4.2–4.3  $\times$  4.8–5.1; tegmen length, 13.2–15.0; interocular width, 1.2.

Remarks. – Shelford (1908a: 5) listed *P. semicincta* as a synonym of *rufiventris* but the pronotum of the former is incompletely or completely ringed by yellow (figs. 57, 59) which is lacking in *rufiventris* (fig. 38) and I provisionally list the two taxa separately until males are studied. I agree with Princis in considering *semicincta* a synonym of *signata*; the posterolateral corners of three abdominal terga are yellow (fig. 58) in both taxa. There is a slight difference in the yellow border of the pronotum, where it is narrowly complete in *signata* and lacking laterally in *semicincta*.

*Pseudothyrsocera circumclusa* (Stål)  
(fig. 60)

*Thyrsocera circumclusa* Stål, 1877: 34 (female). – Shelford 1908b: 469 (synonymized under *circumcincta*), 1908a: 5 (synonymized under *circumcincta*); Sjöstedt 1933: 3. *Hemithyrsocera circumclusa* (Stål). – Kirby 1904: 77. *Pseudothyrsocera circumclusa* (Stål). – Princis 1969: 955 (listed as a synonym of *lugubris*).

Specimens examined. – Lectotype, ♀ (here designated; with an unpublished lectotype label written by Princis, 1968), (abdomen missing), Ins. Philipp., no exact locality, (Philippine Islands) (with handwritten '*Pseudothyrsocera lugubris* (Stål), K. Princis, 1968' on back of his lectotype label); in NRSS.

Redescription. – Female: Head exposed, interocular width greater than distance between ocellar spots and antennal sockets. Pronotum suboval, widest behind middle (fig. 60). Tegmina and wings (damaged) fully developed, former with longitudinal discoidal sectors. Front femur Type B, with four large proximal spines, pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia present (only one front leg present, all others missing). All but first two abdominal terga missing.

Colour. – Head black, ocellar spots and genae yellow, with two small red dots between antennal sockets. Pronotal disk black completely surrounded by a broad yellow band, and with one round and two smaller red maculae on each side within the dark margins of the disk anteriorly (fig. 60). Only the first two abdominal terga are present and these are dark brown without yellow lateral corners. Legs dark brown, outer margins of coxae whitish.

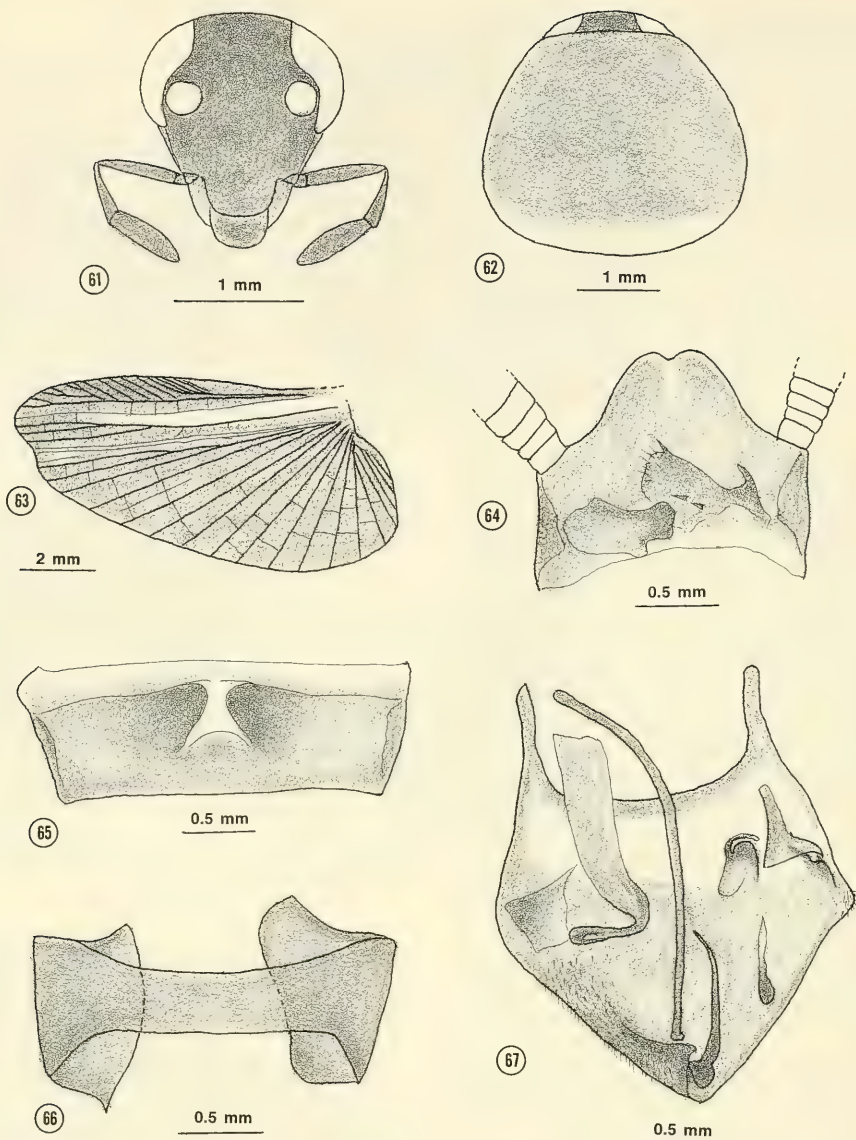
Male: Unknown.

Measurements (mm). – Pronotum length  $\times$  width, 3.7  $\times$  4.3; tegmen length, 11.8; interocular width, 1.1.

Remarks. – Shelford (1908a: 5) synonymized *circumclusa* with *circumcincta*. Princis (1969: 955) listed *circumclusa* as a synonym of *lugubris*, perhaps because of Shelford's synonymy and because Princis believed that *circumcincta* is conspecific with *lugubris*. However, none of the other species of *Pseudothyrsocera* have the small red markings on the pronotum present in *circumclusa* and I am listing it separately until the male is discovered.

*Pseudothyrsocera henrici* Hanitsch  
(figs. 61–67)

*Pseudothyrsocera henrici* Hanitsch, 1935: 17 (male). – Bruijning 1947: 226; Princis 1969: 954.



Figs. 61-67. *Pseudothyrsocera henrici* Hanitsch, male holotype: 61, head and maxillary palps; 62, pronotum; 63, hind wing; 64, supraanal plate and paraprocts; 65, seventh abdominal tergum; 66, ninth abdominal tergum and laterotergites (dorsal; the laterotergites are turned under the tergum); 67, subgenital plate and genitalia (dorsal).

Specimen examined. – Holotype, ♂ (terminalia slide 5), Latimondjong Mountains, Uru, Sulawesi, 800 m, viii-ix.1930, G. Heinrich; in MNHG.

Redescription. – Male: Head exposed, interocular space about the same as the width between antennal sockets; fifth maxillary palpomere enlarged and

longer than the fourth (fig. 61); antennae not plumose (Hanitsch incorrectly described them as plumose). Pronotum suboval (fig. 62). Tegmina and wings fully developed, extending beyond end of abdomen, the former with simple radial vein, and longitudinal discoidal sectors. Hind wing with simple radial and media veins, cubitus vein with two complete



and no distinct incomplete branches (one small, curved, venule), apical triangle absent (fig. 63). Front femur Type A, (as in fig. 12); pulvilli on four proximal tarsomeres, tarsal claws simple, symmetrical, arolium present. First abdominal tergum unspecialized. Seventh abdominal tergum with a pair of shallow depressions anteromedially (hidden by the overlapping sixth tergum) separated by a clear, nonsetose region (fig. 65). Ninth laterotergites weakly dissimilar, the ventral margin of the left one acute at the posterior end, the same margin of the right plate rounded (fig. 66). Supraanal plate produced, symmetrical, hind margin with concave sides, apex shallowly indented; intercercal processes absent; paraprocts dissimilar, the right one with a small spinelike process basally (fig. 64). Subgenital plate, trigonal, asymmetrical, the left side roundly thickened and setose, without a process (also absent on the right side) near the middle; located apically is a long, slender, sclerotized, articulated, erect, spinelike left style; well separated to the right and lying against the surface of the plate, is the smaller, dissimilar right style which is dark on its proximal half and becomes membranous and colourless distally (this style is completely hidden in the pinned specimen; Hanitsch incorrectly stated that styles are absent even though the large left one is exposed in the pinned specimen.) (fig. 67). Genitalia as in fig. 67: hook on the left side with a small preapical structure; median phallomere a simple, apically blunt rod; right phallomere much smaller than the genital hook, consisting of three sclerites, one of them a small cleft.

Colour. – Head with occiput and vertex black, shading into dark reddish brown (fig. 61); palps and antennae dark. Pronotum brownish yellow, lateral borders subhyaline, hind border whitish (fig. 62). Tegmina hyaline, reddish brown, weakly infuscated in the apical region. Wings darkly fuscated, region between the media and cubitus veins mostly colourless (fig. 63). Abdominal terga dark brown, medial gland area on segment seven pale (fig. 65). Abdominal sterna light brownish. Legs dark reddish brown, coxae weakly infuscated. Cerci dark brown on both surfaces, apical segment pale.

Female: Unknown.

Measurements (mm). – Length, 17.0; pronotum length  $\times$  width,  $2.9 \times 3.2$ ; tegmen length, 10.0; interocular width, 0.8.

Remarks. – Hanitsch (1935) stated that *henrici* is closely allied to *xanthophila*, the other *Pseudothyrocera* from Sulawesi, but differs in colour. However, although there are some similarities between the two taxa, (e.g. Type A, front femur, only the seventh abdominal tergum specialized, widely separated styles), I place *henrici* in the *lugubris*-

species-group, and *xanthophila* in the *fulva*-species-group because of differences in the shapes of their subgenital plates.

### *Pseudothyrocera sinensis* (Walker) comb. n.

*Ischnoptera sinensis* Walker, 1869: 148 (male).

*Phyllodromia sinensis* (Walker). – Shelford 1908a: 13.

*Periplaneta apicalis* Shiraki (in part), 1931: 181 (female not male as indicated; female = *Hebardina* sp.). – Asahina 1979: 339.

*Symploce sinensis* (Walker). – Bey-Bienko 1950: 155, figs. 54–56 (male & female); Princis 1959: 134 (male).

*Episymploce sinensis* (Walker). – Asahina 1979: 339, figs. 1A–C, 3A, 4A–E (male & female); Roth 1987c, 130, figs. 1A–I, 2A–C (redescriptions).

The shape and markings of the tegmina and wings (Asahina 1979, fig. 3A; Roth 1987c, figs. 1H, I) are characteristic of *Pseudothyrocera*. The trigonal shape of the subgenital plate and styles (Roth 1987c, fig. 1C) place the species in the *lugubris*-species-group.

### Distribution of *Pseudothyrocera* by species:

*circumcincta*: Philippines

*circumclusa*: Philippines

*fulva*: Sumatra

*henrici*: Sulawesi

*lugubris*: Philippines

*montana*: Sarawak

*perkinsi*: Malaya

*rectangularitervittata*: Borneo; Sarawak

*rubronigra*: Malaya

*rufiventris*: Philippines

*scutigera*: Sabah; Sarawak

*signata*: Philippines

*sinensis*: Hong Kong; Taiwan

*xanthophila*: Sulawesi; Sumatra

### Distribution by country or regions:

Borneo: *rectangularitervittata*

Hong Kong: *sinensis*

Malaya: *perkinsi*; *rubronigra*

Philippines: *circumcincta*; *circumclusa*; *lugubris*;

*rufiventris*; *signata*

Sabah: *scutigera*

Sarawak: *montana*; *rectangularitervittata*; *scutigera*

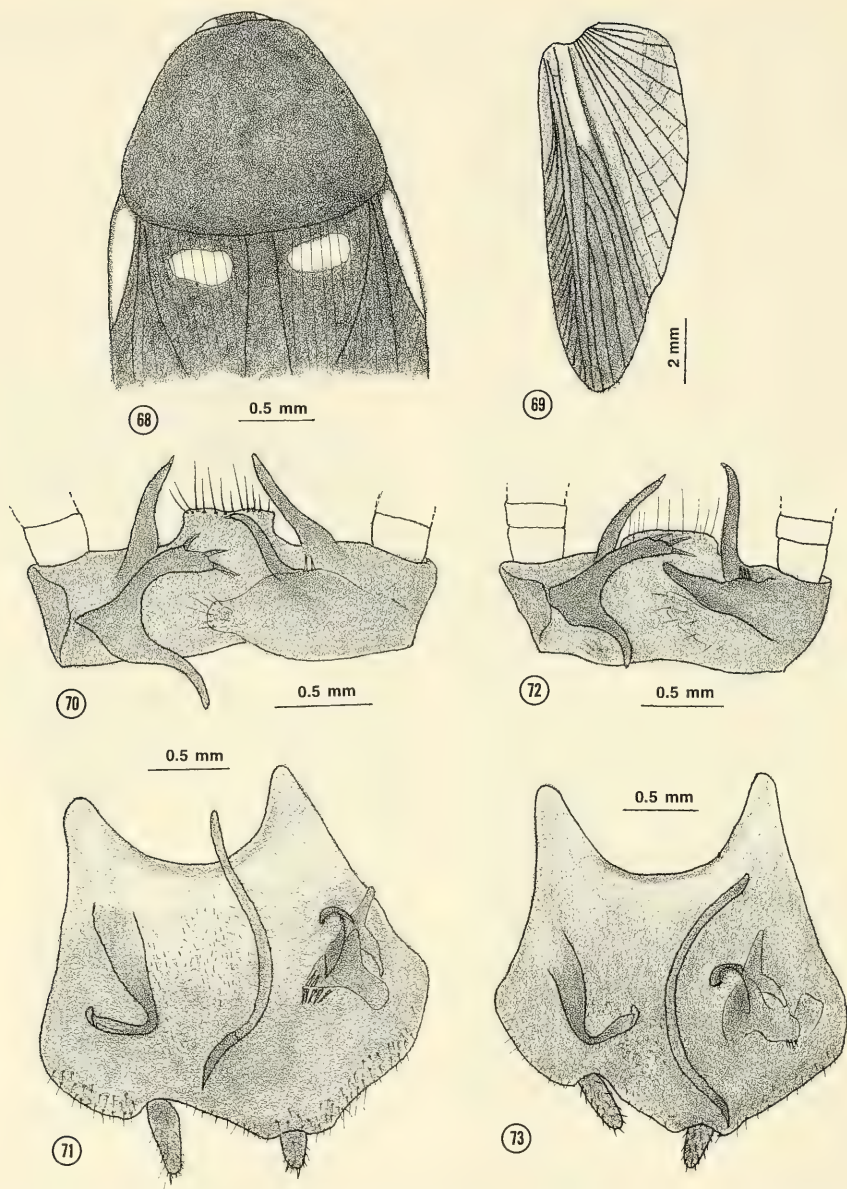
Sulawesi: *henrici*; *xanthophila*;

Sumatra: *xanthophila*

Taiwan: *sinensis*

### Genus *Haplosymploce* Hanitsch

*Haplosymploce* Hanitsch, 1933b: 236. – Hanitsch 1933a: 128; Princis 1951: 56 (footnote: selected *Ischnoptera nigra* Hanitsch as the type species).



Figs. 68-73. *Haplosymploce* spp. 68-71. *H. pica* (Walker): 68, pronotum and proximal part of the tegmina (male lectotype); 69, hind wing (♀ paralectotype from Sumatra); 70, 71, male paralectotype from Singapore: 70, supraanal plate, intercercal processes, and paraprocts (ventral); 71, subgenital plate and genitalia (dorsal). 72, 73, *H. ruficollis* (Shelford), male holotype: 72, supraanal plate, intercercal processes, and paraprocts (ventral); 73, subgenital plate and genitalia (dorsal).

Princis (1969: 875) listed six species of *Haplosymploce*, namely: *nigra* Hanitsch, *montis* Shelford, *reversa* Walker, *guttifera* Walker, *walkeri* Princis, and *curta* Hanitsch. *Symploce bicolorata* Roth is a junior synonym of *H. montis*, and *Symploce ferruginea* Roth is a junior synonym of *Haplosymploce nigra*.

*Pseudothyrocera pica* Walker, *P. ruficollis* Shelford, *P. moultoni* Hanitsch, and *P. andamanica* (Princis) are transferred to *Haplosymploce*. *Blatta guttifera* Walker belongs in the genus *Beybienkoa* Roth, and *Beybienkoa papuensis* (Roth) originally described as a *Symploce* is a junior synonym of *Beybienkoa guttifera*. *Haplosymploce walkeri* Princis (= *Blatta elegans* Walker) is *Hemithyrocera walkeri*. I have not seen *Haplosymploce curta* Hanitsch (male unknown) but am retaining it in that genus until the male is described.

**Rediagnosis.** – Hanitsch's diagnosis of this genus is: 'Front femur armed after Type A; radial vein both of tegmina and wings simple, ulnar [= cubitus] vein sigmoid, with several complete and one or more incomplete branches, no apical triangle'. A study of the species of *Haplosymploce* listed in Princis's catalogue shows that variation of the above characters makes it difficult to place some of the species in this genus and a rediagnosis follows: Antennae not plumose. Tegmina and wings fully developed, the former with simple radial vein and longitudinal or weakly oblique discoidal sectors. Hind wing with simple radial vein, cubitus vein oblique, or subsigmoid, with three to five complete and zero to four incomplete branches, apical triangle absent. Front femur variable: Type A (fig. 85), or B (figs. 81, 84), (more than one type of femur may occur in the same species); pulvilli on four proximal tarsomeres, tarsal claws simple, symmetrical, arolia small. Male: First and seventh abdominal terga specialized (figs. 87, 88), or only the first segment with a medial gland. Paraprocts dissimilar, large intercercal processes present on the ventral surface of the subgenital plate near the bases of the cerci (e.g., figs. 70, 74, 82, 90). Subgenital plate asymmetrical, generally similar in shape in all the species (e.g., figs. 71, 73, 83, 91); styles small, similar in shape, equal or slightly different in length, cylindrical, (figs. 71, 73, 83, 91, 100). Genital hook on the left side, with a preapical incision; median phallomere a stout or slender rod, sometimes with a setal patch near the acute apex (figs. 80, 83, 100).

**Remarks.** – The shapes of the male subgenital plate and styles, are similar in all species of *Haplosymploce*. I place eight of the ten species of *Haplosymploce*, whose males are known, in the following two species groups:

1. *pica*-species-group. – Only the first abdominal tergum specialized. Front femur Type A. Cubitus vein of hind wing with three or four complete and no incomplete branches. Species: *bicolor*; *moultoni*; *pica*; *ruficollis*.

2. *nigra*-species-group. – First and seventh abdominal terga specialized. Front femur Type A or B. Cubitus vein of hind wing with four or five complete and two or three incomplete branches. Species: *andamanica*; *montis* (= *bicolorata*); *nigra* (= *ferruginea*); *reversa*.

### Key to known males of *Haplosymploce*

1. Only the first abdominal tergum specialized. Front femur Type A. Cubitus vein of the hind wing with three or four complete and no incomplete branches. (*pica*-species-group) . . . 2
- Abdominal terga one and seven specialized. Front femur Type A or B. Cubitus vein of hind wing with four or five complete and two or three incomplete branches. (*nigra*-species-group) . . . . . 4
- 2 (1) Tegmina yellowish, with the basal and apical regions black. Wings with base and apex black (figs. 76, 77) . . . . . *bicolor*
- Tegmina with pale spots in the subcostal zone and bases of the anal zone (figs. 68) . . . . . 3
- 3 (2) Pronotum black . . . . . *pica*
- Pronotum red . . . . . *ruficollis*
- 4 (1) Pronotal disk with a solid dark macula surrounded by pale orange-yellow (fig. 93) . . . . .
- Pronotal disk completely dark . . . . . 5
- 5 (4) Tegmina pale yellowish-white, transparent, strikingly lighter than the dark pronotum (fig. 8A in Roth 1985b) . . . . . *montis* (= *bicolorata*)
- Tegmina and pronotum dark . . . . . 6
- 6 (5) Femora pale with their apices dark brown (figs. 84-86). Supraanal plate, paraprocts, and intercercal processes as in fig. 90 . . . . . *reversa*
- Femora completely dark (as in fig. 81). Supraanal plate, paraprocts, and intercercal processes as in fig. 82, and figs. 10F, G, in Roth 1985b . . . . . *nigra* (= *ferruginea*)

### *pica*-species-group

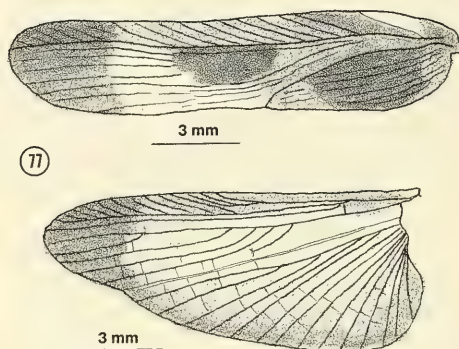
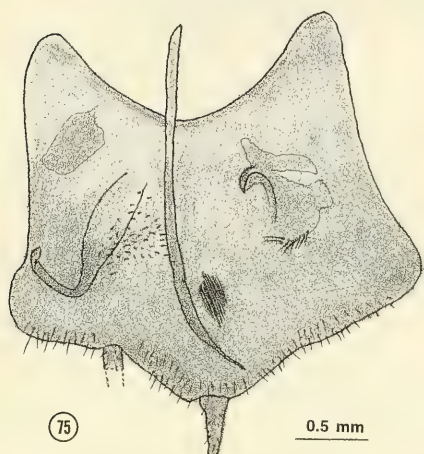
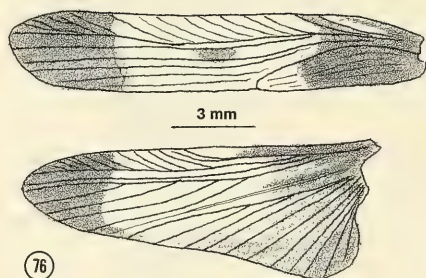
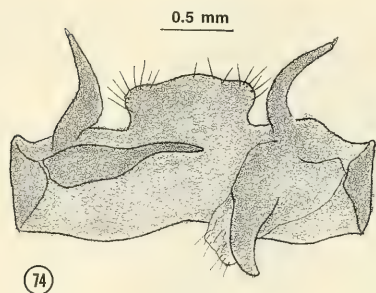
*Haplosymploce pica* (Walker) comb. n.  
(figs. 68-71)

*Pseudomops pica* Walker, 1868: 213 (male).

*Thyrocera pica* (Walker). – Kirby 1904: 78.

*Pseudothyrocera pica* (Walker). – Shelford, 1906: 250, 1907: 488; 1908a: 5, pl.1, fig. 3 [habitus]; Hanitsch 1915: 34, pl. 7, fig. 37 (male) [habitus], 1919: 72, 1923: 463; Hebard 1929: 10; Bruijning 1948: 95.





Figs. 74-77. *Haplosymploce* spp. 74-76, *H. bicolor* (Shelford), male holotype: 74, supraanal plate, intercercal processes, and paraprocts (ventral); 75, subgenital plate and genitalia (dorsal); 76, left tegmen (top) and hind wing (bottom). 77, *H. moultoni* (Hanitsch), female holotype, left tegmen (top) and hind wing (bottom).

Specimens examined. — Lectotype, ♂ (here designated), (terminalia slide 296), Singapore, Wallace, Mr. Saunder's collection; Type Orth. 47 $\frac{1}{3}$  in HECO. Paralectotypes. Singapore. HECO: 1 ♂ (terminalia slide 297), same data as lectotype, Type Orth. 47 $\frac{1}{3}$ . Sumatra. HECO. 1 ♀, Wallace, in Mr. Saunder's Collection, Type Orth. 47 $\frac{1}{3}$ .

Redescription. — Male: Head with interocular space greater than the width between antennal sockets; fifth maxillary palpomere longer than the fourth; antennae with proximal and distal segments not plumose, the antennomeres between them thickened and densely plumose. Pronotum subparabolic, smooth, hind margin rounded (fig. 68). Tegmina and wings fully developed extending beyond the end of the abdomen, the former with longitudinal discoidal sectors. Hind wing with simple radial vein, cubitus

vein with three or four complete and no incomplete branches, apical triangle absent (fig. 69). Front femur Type A, with four long proximal spines succeeded by a row of short stout equal spines (stouter than spinules), pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum with a median setose gland. Seventh abdominal tergum unspecialized. Supraanal plate symmetrical, transverse, median region broadly produced and setose; intercercal processes large, paraprocts dissimilar, the left one sclerotized with three terminal spines (fig. 70). Subgenital plate asymmetrical, left side of hind margin shallowly excavated, with a pair of cylindrical styles, the left one larger (fig. 71). Genitalia as in fig. 71: hook on the left side with a preapical incision and with a minutely spicular clear membrane; median phallomere a curved, apically acute rod; right phallomere consisting of three scler-

rites one a cleft, another with four or seven small spines.

Female: Front femur with five or six long proximal spines succeeded by a row of slender spinules and terminating in three heavy spines (Type B.). Supraanal plate trigonal, sides weakly concave, apex rounded, reaching hind margin of subgenital plate.

Colour. – Head black, shiny; maxillary palpomeres and antennae black. Pronotum black. Tegmina black with subcostal (mediastine) area white, and with a large, white macula at the base of the anal field (fig. 68). Hind wing darkly infuscated except for a colourless proximal region in the anterior field (fig. 69). Abdomen black. Coxae with basal region black, distally and part of the outer border whitish; femora, tibiae and tarsi black.

Measurements (mm) (♀ in parentheses). Length, 9.8 (11.2); pronotum length  $\times$  width, 3.3–3.6  $\times$  3.6–3.9 (3.9  $\times$  4.2); tegmen length, 11.5–12.0 (13.3); interocular width, 1.1–1.2 (1.4).

Remarks. – The subgenital plate, styles and genitalia are similar to those of *Pseudothyrsocera ruficollis* (see remarks below, under that species).

*Haplosymploce ruficollis* (Shelford) comb. n.  
(figs. 72–73)

*Pseudothyrsocera ruficollis* Shelford, 1906: 251, pl. 14, fig. 6 (habitus) (male). – Shelford 1908a: 5; Hanitsch 1915: 35, pl. 7, fig. 36 (habitus), 1923: 463; Hebard 1929: 10; Bruijning 1948: 95.

Specimen examined. – Holotype, ♂ (terminalia slide 298), Penang [Pinang, Malaysia], Cantor; Type Orth. 48 in HECO.

Redescription. – Male: Head with interocular space greater than the distance between antennal sockets; antennae missing. [When Shelford described the species, the antennae were mutilated. He stated that when intact specimens are found the basal half of the antennae probably would be plumose, as in *pica*. Hanitsch (1915: 35) did see two additional specimens from Sarawak and Selangor, and found that the antennae are plumose]. Pronotum subparabolic. Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal discoidal sectors. Hind wing with simple radial and media veins, cubitus vein with three complete and no incomplete branches, apical triangle absent. Legs missing. First abdominal tergum with a setose gland. Seventh abdominal tergum unspecialized. Supraanal plate with the median region produced, intercercal processes large, similar, paraprocts dissimilar, the left

one with three terminal spines (fig. 72). Subgenital plate asymmetrical, the hind margin on the left side weakly excavated, with a pair of similar, widely separated styles (fig. 73). Genitalia as in fig. 73: hook on the left side with a preapical incision; median phallomere a slender, curved, apically acute rod; right phallomere consisting of four sclerites one of which is a small cleft.

Colour. – Head and pronotum red; maxillary palpi and antennae black. Tegmina black with a yellowish-white macula on the subcostal (mediastinal) region and at the base of the anal field. Wings dark brown, pale in the proximal region, veins mostly dark (yellowish at the bases of the veins in the anterior and posterior fields). Coxae with their outer borders and distal ends yellowish-white.

Female: Unknown.

Measurements (mm). – Length, 12.0; pronotum length  $\times$  width, 3.7  $\times$  4.2; tegmen length, 13.2; interocular width, 1.3.

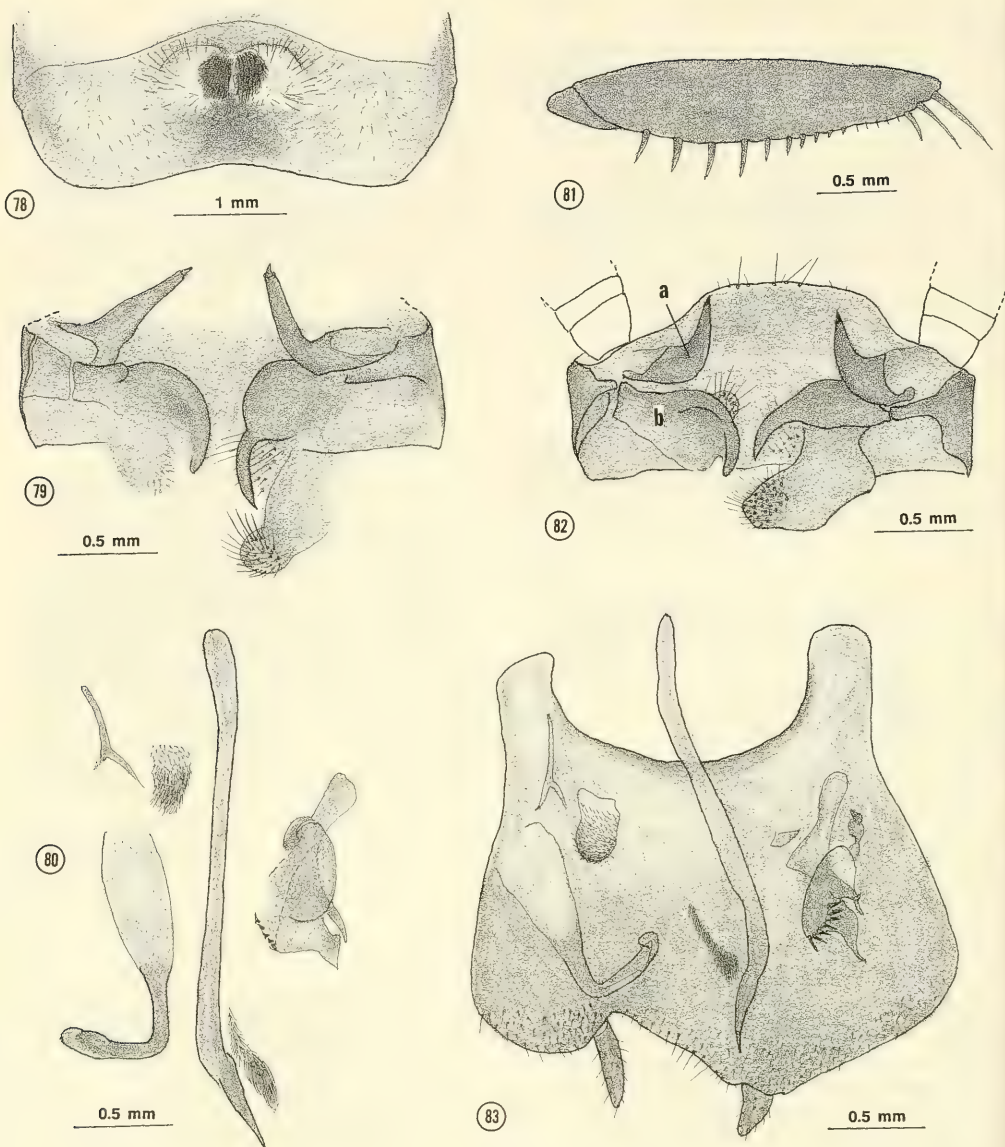
Remarks. – Shelford (1906: 251) was correct in saying that *ruficollis* is most closely allied to *pica*, a conclusion supported by the strong similarity in the two species of the subgenital plate, styles, genitalia, supraanal plate, paraprocts, and intercercal processes (cf. figs 70, 71 with 72, 73). In fact, *ruficollis* may eventually prove to be a colour variant of *pica*. The tegminal colour and markings are similar (the medial macula is much larger and more distinct in *moultoni*), but the colour differences of the head and pronotum are strikingly different and readily separate the two taxa.

*Haplosymploce bicolor* (Shelford) comb. n.  
(figs. 74–76)

*Pseudothyrsocera bicolor* Shelford, 1909: 612 (male). – Hanitsch 1915: 36 (male), 1923: 463; Hebard 1929: 10; Bruijning 1948: 94; Princis 1969: 955.

Specimen examined. – Holotype, ♂ (terminalia slide 300), Mt. Matang, N.W. Borneo [Sarawak], vi.1900; Type Orth. 50 in HECO.

Redescription. – Male: Head with interocular space greater than the distance between the antennal sockets; about the basal two thirds of the antennae densely plumose. Pronotum suboval. Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal discoidal sectors (fig. 76, top). Hind wing with simple radial and media veins, cubitus vein with four complete (not five as stated by Shelford) and no incomplete branches, apical triangle absent (fig. 76, bottom). Front femur



Figs. 78-83. *Haplosymploce* spp. males. 78-80, *H. montis* (Shelford), holotype: 78, seventh abdominal tergum; 79, subgenital plate, interceral processes, and paraprocts (ventral); 80, genitalia (dorsal). 81-83, *Haplosymploce nigra* Hanitsch: 81, (lectotype) front femur (anterior surface); 82, 83 (paralectotype): 82, supraanal plate, interceral processes, and paraprocts (ventral; a, left interceral process; b, left paraproct); 83, subgenital plate and genitalia (dorsal).

Type A<sub>1</sub>, or A<sub>1</sub> (the first of the four terminal spines is only slightly longer than the one preceding it); pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum with

a setal specialization. Seventh abdominal tergum unspecialized. Supraanal plate transverse, symmetrical, midregion of the hind margin produced, interceral processes, large, similar, right and left paraprocts dis-



similar (fig. 74). Subgenital plate almost symmetrical, styli widely separated (fig. 75; Shelford (1909) stated that the left style is much longer than the right one; however, the slide preparation shows that the left style is damaged and is missing the distal region.). Genitalia as in fig. 75: hook on the left side with a preapical incision; median phallomere a slender, apically acute rod and near the apex, but separated from it, is a small, dark, dense group of setae; right phallomere consists of three sclerites one of which is a cleft.

Colour. – Head black; maxillary palpi black; basal two thirds of the antennae black, the distal third beyond the plumose region, yellow. Pronotum black. Proximal and apical region of the tegmina black, the intermediate zone yellowish with a small dark spot in the middle, and with a yellowish spot in the subcostal region (fig. 76, top). Wings with base and apex blackish, remainder hyaline (fig. 76, bottom). Abdominal terga and sterna black. Legs black except for the coxae whose apical halves and outer margins are yellowish.

Female: Unknown.

Measurements (mm). – Length, 11.5; pronotum length  $\times$  width,  $4.4 \times 5.4$ ; tegmen length, 14.2; interocular width, 1.4.

Remarks. – The striking colour of the tegmina and wings readily identify this species.

*Haplosymploce moultoni* (Hanitsch) comb. n. (fig. 77)

*Pseudothyrsocera moultoni* Hanitsch, 1915: 36, pl. 3, fig. 16 (female). – Hanitsch 1923: 463; Hebard 1929: 10; Bruijning 1948:95; Princis 1969: 955.

Specimen examined. – Holotype ♀, Mt. Merinjak, Sarawak, 2200 feet, 19.v.1914, Moulton; Type Orth. 260 in HECO (The specimen is fragmented and parts are mounted on cards.)

Redescription. – Female: Head with interocular space greater than the distance between antennal sockets; antennae missing (according to Hanitsch, the antennae are plumose). Pronotum parabolic. Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal discoidal sectors (fig. 77, top). Hind wing with simple radial and media veins, the cubitus vein with four complete and one incomplete branches, apical triangle absent (fig. 77, bottom). Front femur Type A; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. Supraanal plate damaged.

Colour. – Head reddish brown with a large black macula on the genae; antennae black, except for a few distal white segments, terminal antennomeres black (from Hanitsch). Tegmina reddish brown with three large maculae, one occupying almost the entire anal field, a second medially, and the third at the apex (fig. 77, top). Hind wing with apical region of the anterior field dark brown and black, remaining region yellowish; posterior field infuscated, darker basad and posteriorly (fig. 77, bottom). Abdomen reddish brown. Legs with coxae black basally, yellowish distally and along the outer border, femora black with a yellowish band along the ventral margin, tibiae, tarsi, and cerci black.

Male: Unknown.

Measurements (mm). – Length, 12.5; pronotum length  $\times$  width,  $4.6 \times 5.3$ ; tegmen length, 14.3; interocular width, 1.5.

Remarks. – Based on the colour and pattern of the tegmina and wings, *moultoni* and *bicolor* may prove to be synonyms when the male of the former is found, and larger series are examined to determine the extent of colour variation.

*Haplosymploce montis* (Shelford) (figs. 78-80)

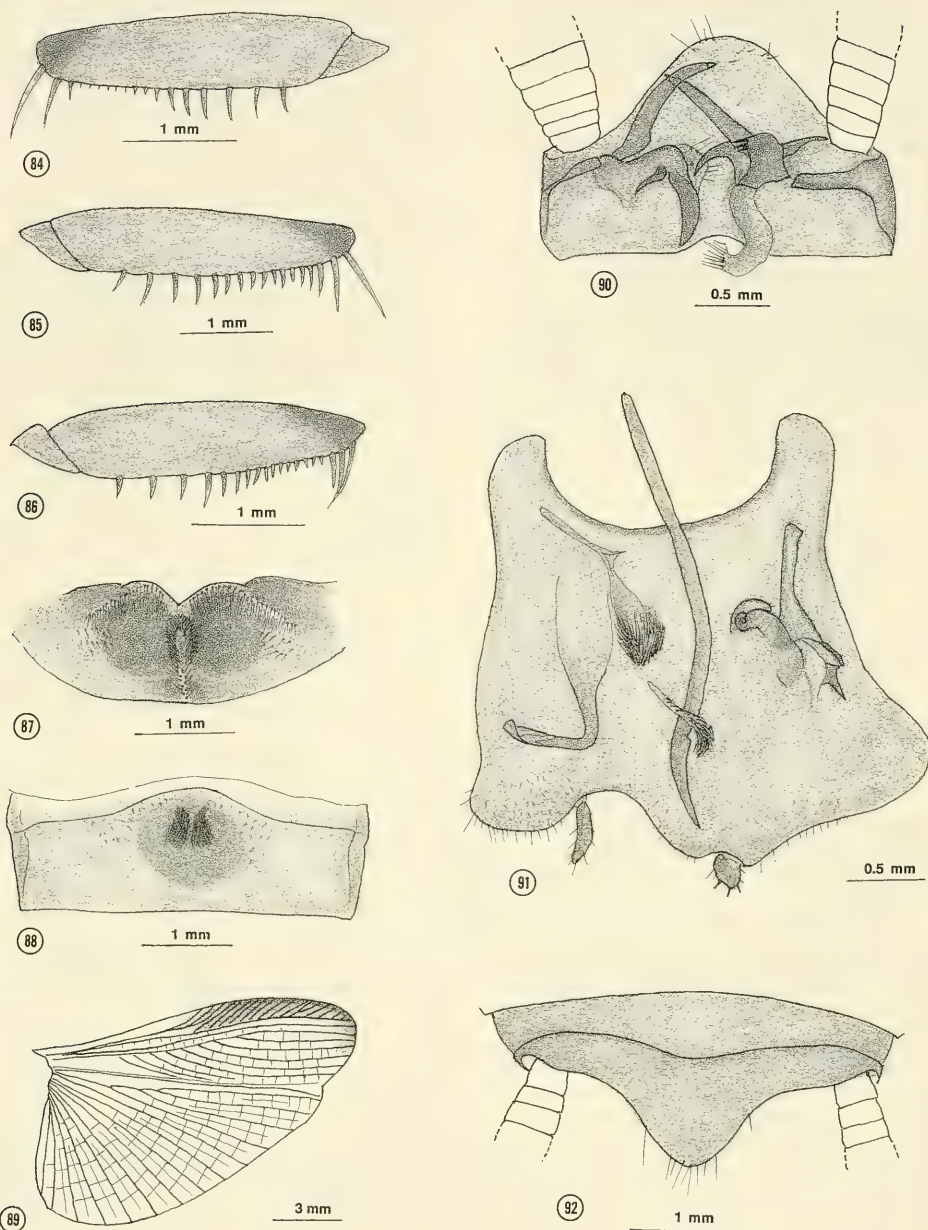
*Ischnoptera montis* Shelford, 1906: 266, pl. XVI, fig. 10 (male). – Shelford 1908a: 7; Hanitsch, 1915: 39, 1923: 463.

*Parasymploce montis* (Shelford). – Hebard 1929: 10.

*Haplosymploce montis* (Shelford). – Bruijning 1948: 76, figs. 13, 37; Princis 1950a: 178.

*Symploce bicolorata* Roth, 1985b: 148, figs. 8, 9 (male not female, see remarks). **Syn. n.**

Specimens examined. – Holotype ♂ of *Ischnoptera montis* Shelford (terminalia slide 258), N.W. Borneo, Sarawak, Mt. Matang nr Kuching, 2.v.1902, pres. 1905 by the Sarawak Museum; Type Orth. 57, in HECO. Additional specimens. – Sabah. RMNH: N. Borneo, 12.5 km S. Nabawan, Kg. Pamuntaria, nr. river, 116.27E 5.02N, 400 m, 1♂, 16.xi.1987, J. Huisman & R. de Jong. BPBM: Tawau, Quoin Hill, Cocoa Res. Sta., light trap, ♂ holotype No. 13472 (wing on slide 214), 17.ix.1962, and 1♂ paratype (terminalia slide 213), 3.ix.1962, Y. Hirashima, of *Symploce bicolorata* Roth; Tawau, Quoin Hill, Cocoa Res. Sta., Malaise, 225 m, 2♂, 20.ix.1962, Y. Hirashima, in jungle, light trap, 2♂, 3-7.vii.1962, H. Holtmann; Forest Camp, 19 km north of Kalabakan, 1♂, 1.xi.1962, 60 m, 1♂, 27.x.1962, K.J. Kuncheria. ZILS: Malaysia, Sabah, Sipitang, Mendolong, 1♂, 25.xi.1987, A1L, 1♂, 5.iv.1988, 1♂, 30.iv.1988, 1♂, 6.iv.1988, 3♂, 5.v.1988, 1♂,



Figs. 84-92. *Haplosymploce reversa* (Walker). 84-85, front femora (anterior surfaces): male and female respectively, from Kedah Peak; 86-91, male holotype: 86, front femur (anterior surface); 87, first abdominal tergum (pinned specimen); 88, seventh abdominal tergum (slide preparation); 89, hind wing; 90, supraanal plate, intercercal processes, and paraprocts (ventral); 91, subgenital plate and genitalia (dorsal); 92, female from Kuala Lumpur, supraanal plate (dorsal).

iii.1989, S. Adebratt. Two retained at MCZC. Malaya. BPBM: Malay Pen., S.E. Pahang, Rompin Mining Co., Railway Track, 50 km, 1♂, 9.iv.1961, K.J. Kuncheria. Sumatra. RMNH: Tanangtalu, 1♂, v.1915, E. Jacobson. ZMAN: Bandar Baru, 850 m, 1♂, ii.1921, J.B. Corporaal (Sumatran specimens reported by Bruijning 1948: 76).

Remarks. – The distal parts of the supraanal and subgenital plates (and styles) are missing from the type of *montis* but the intercercal processes and paraprocts (fig. 79), genital phallomeres (fig. 80), and the specializations on the seventh (fig. 78) and first abdominal terga are intact. The front femur is Type A, but the row of preterminal spines are small and similar in length but stouter than piliform spinules; other specimens of *montis* have Type B, or intermediate between A<sub>1</sub> and B<sub>1</sub> (a mixture of piliform spinules and stout spines of the same length). These structures, as well as the distinctive colour pattern of dark reddish brown pronotum and pale yellowish-white semi-transparent tegmina (although there is some variation in the pronotal colour, some being lighter than others) are so similar to those of *Symptloce bicolorata* Roth (1985c: fig. 8) that I am synonymizing the two species. The measurements (mm) of the present male specimens are as follows: Length, 11.0–16.0; pronotum length × width, 3.5–4.0 × 4.1–4.6; tegmen length, 14.0–15.0; interocular width, 0.8.

The female paratype of *S. bicolorata* from Pelawan besar, Kalimantan, is not *Haplosymploce montis* but is possibly a species of *Symploce*.

*Haplosymploce nigra* (Hanitsch)  
(figs. 81–83)

*Ischnoptera nigra* Hanitsch, 1928: 15, pl. 1, fig. 6 (male).

*Haplosymploce nigra* (Hanitsch), 1933b: 237; Bruijning 1948: 76; Princis 1969: 875.

*Symploce ferruginea* Roth, 1985b: 152, figs. 10, 11 (male and female). *Syn. n.*

Specimens examined. – Lectotype, ♂ (here designated), Mentawe[al] Island, Siberoet, 15.ix.1924, H.H. Karny; Type Orth. 325 $\frac{1}{2}$  in HECO. Paralectotype: Sumatra. HECO: N. Pagi Island, West Sumatra, Type Orth. 325 $\frac{1}{2}$ , 1♂ (terminalia slide 256), x.1924, C.B.K. & N.S. Additional specimens. – West Malaysia. HECO: Pahang, Fraser's Hill, 4000 ft., ♂ holotype (terminalia slide 193) of *Symploce ferruginea* Roth (Type Orth. 970), 1.vi.1932, H.M. Pendlebury. Sabah. BPBM: Forest Camp, 19 km north of Kalabakan, 60 m, light trap, ♀ paratype of *Symploce ferruginea* Roth, 29.x.1962, Y. Hirashima. ZILS: Malaysia, Sabah, Sipitang, Mendolong, 1♀, 29.xii.1987, A1L, 1♀, iii.1988, 1♀, 5.iv.1988, 1988,

1♀, 6.iv.1988, 1♀, 5.v.1988, W5L, 1♀, 19.iv.1988, S. Adebratt. Two retained in MCZC. RMNH: Malaysia-SE. Sabah, nr. Danum Valley Field C., c. 150 m, WO Mal. trap 5, 1♀, 20.vi. –12.vii.1987, C. v. Achterberg & D. Kennedy; N. Borneo, Sabah, 24 km on rd. Keningau-Kimanis (N. side), 116.03E 5.27N, 1350 m, 1♀, 19.xi.1987, J. Huisman & R. de Jong.

Redescription. – Male: Head hidden, interocular space about the same as the distance between antennal sockets. Pronotum suboval. Tegmina and wings fully developed extending beyond end of abdomen, the former with simple radial vein and weakly oblique discoidal sectors. Hind wing with simple radial vein, cubitus oblique, weakly sigmoid, with four or five complete and two or three incomplete branches, apical triangle absent (Hanitsch 1928: pl.1, fig. 6). Front femur with eight or nine stout proximal spines, the basal five or six about equal in length, the others much smaller, succeeded by five to eight piliform spinules and three large terminal spines (fig. 81) [Type B<sub>1</sub>; Hanitsch (1928: 15) stated that the anterior edge of the front femur of *nigra* has '... 4 large spines, followed by 5 shorter ones (type A)'; actually the stout spines are succeeded by a short row of piliform spinules which classify the femur as Type B<sub>1</sub>; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum with a large depression and a dense group of setae medially. Seventh abdominal tergum with a depression and large medial tuft of setae. Supranal plate, paraprocts, and intercercal processes as in fig. 82. Subgenital plate and genitalia as in fig. 83.

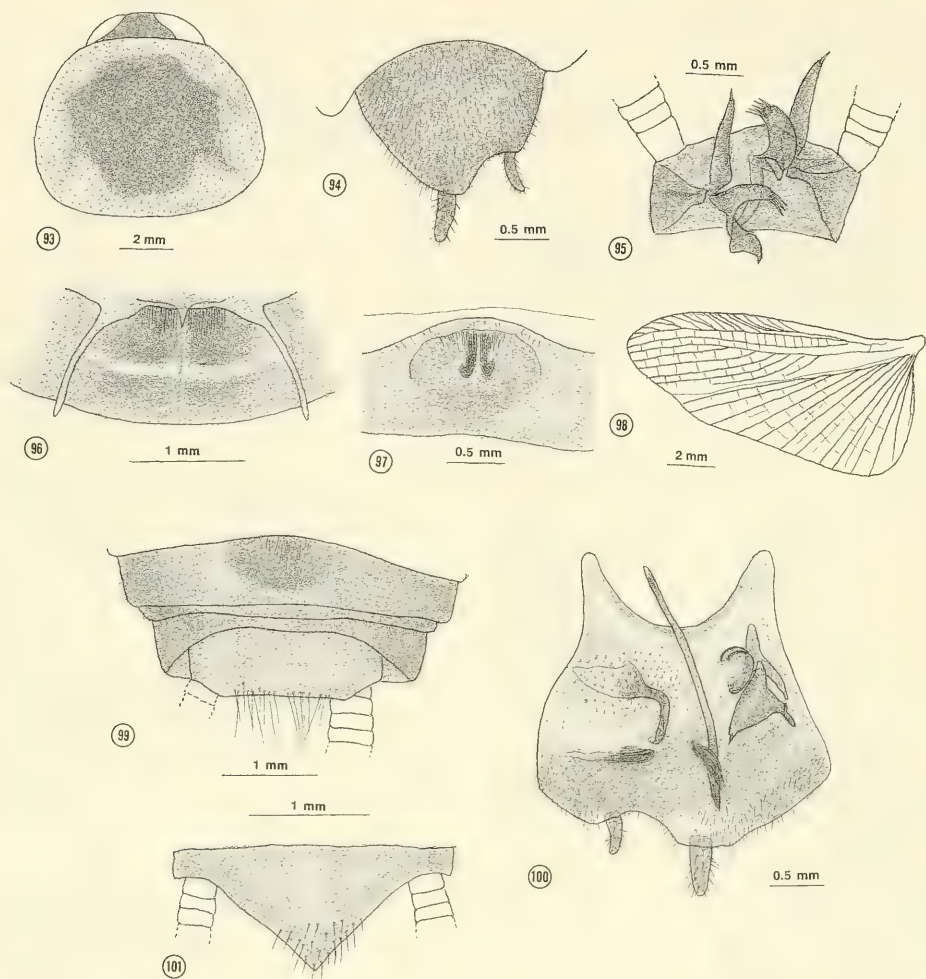
Female (illustrated in Roth, 1985b, figs. 11A–C). Front femur Type A<sub>1</sub>. Cubitus vein of hind wing oblique or subsigmoid, with six or seven complete and three incomplete branches, apical triangle absent. Supraanal plate trigonal.

Colour. – Varies from dark reddish brown to blackish brown. Legs (femora, tibiae, tarsi), and cerci dark. Wings dark brown.

Measurements (mm) (♀ in parentheses). – Length, 10.2–10.7 (12.0–18.0); pronotum length × width, 3.3–3.4 × 4.0–4.1 (4.3–4.7 × 5.2–5.8); tegmen length, 11.5–12.5 (16.5–19.5); interocular width, 0.9 (0.9–1.0).

Remarks. – I am synonymizing *ferruginea* with *nigra* because the differences between their males are minor. Similarities between the intercercal processes, paraprocts, and genitalia suggest a close relationship between *Haplosymploce nigra* and *H. montis* (cf., figs. 79, 80, with 82 and 83).





Figs. 93-101. *Haplosymploce andamanica* (Princis), types. 93-100, male holotype: 93, pronotum; 94, subgenital plate (ventral); 95, supraanal plate, paraprocts, and intercercal processes (ventral); 96, glandular region on first abdominal tergum; 97, gland on seventh abdominal tergum (slide preparation); 98, hind wing; 99, abdominal terga seven to ten (supraanal plate); 100, subgenital plate and genitalia (dorsal); 101, female paratype, supraanal plate (dorsal).

*Haplosymploce reversa* (Walker)  
(figs. 84-92)

*Ischnoptera reversa* Walker, 1869: 147 (male). – Kirby 1904: 81; Shelford 1907: 489, 1908a: 7; Hanitsch 1915: 37, 1923: 398.

*Parasymploce reversa* (Walker). – Hebard 1929: 10.

*Haplosymploce reversa* (Walker). – Bruijning 1948: 78, fig. 38; Princis 1969: 875.

Specimens examined. – Holotype, ♂ (terminalia slide 257), Singapore, Wallace, W.W. Saunders coll.,

purch. and pres. '73 by Mrs. F.W. Hope; Type Orth. 54 in HECO [Mr. I. Lansbury informed me that the holotype was almost totally destroyed in the return mail; he placed the remnants in a 'container' and attached it to the type pin]. Additional specimens. – West Malaysia. HECO: Kuala Lumpur, Malay Pen., 1 ♀, ex coll. Dept. Agric.; Kedah Peak, 3300 ft., 1 ♂, 11.iii.1928, 1 ♀, 25.iii.1928.

Redescription. – Male: Interocular space slightly

less than distance between antennal sockets. Pronotum subparabolic. Tegmina and wings fully developed extending beyond end of abdomen, the former with simple radial vein and longitudinal discoidal sectors. Hind wing with simple radial vein, cubitus vein with five complete and three or four incomplete branches, apical triangle absent (fig. 89), the triangular region folded when at rest. Front femur Type A, (fig. 86, holotype; six spines preceding the three long terminal spines are small and about the same length but are stouter than piliform spinules) (the femur of a male from Medan, Sumatra, also is Type A, see Bruijning 1948: 78, fig. 38), or Type B, with nine stout proximal spines decreasing in length distad, succeeded by six piliform spinules and terminating in three large spines (fig. 84, ♂ from Kedah Peak, West Malaysia); pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum with a pair of deep fossae divided medially by a longitudinal ridge bearing a dense group of setae and with setae along the anterior margins of the fossae (fig. 87). Seventh abdominal tergum with two, almost contiguous groups of setae in a shallow depression (fig. 88; this gland may be hidden by the overlapping sixth tergum). Supraanal plate symmetrical hind margin convexly rounded, entire; intercercal processes weakly dissimilar, spinelike, right and left paraprocts dissimilar, the right one with a curved, spinelike process and a dark sclerite bearing three small, dark, spines (fig. 90). Subgenital plate asymmetrical with dissimilar styles, the left one more slender (fig. 91). Genitalia as in fig. 91: hook on the left side with a preapical incision; also on the left side is a setose sclerite; median phallomere a dark, curved, apically acute rod with a small setose sclerite near the apex; right phallomere consisting of at least two sclerites one of which is a reduced cleft.

Female: Interocular space about the same as distance between antennal sockets. Cubitus vein of hind wing with five or six complete and two incomplete branches, apical triangle absent. Front femur Type A, (sometimes the last four or five spines are longer than the preceding ones thus appearing to be Type A, or A, as in fig. 85). Supraanal plate subtrigonal, sides of the hind margin concave, apex rounded (fig. 92).

Colour. – Head reddish brown without markings; proximal segments of antennae dark brown, remainder light brown; segments four and five of maxillary palpi and last segment of labial palpi dark brown, other segments pale. Pronotum reddish brown, without markings, lateral borders opaque. Tegmina hyaline, reddish brown. Hind wing with costal vein region yellowish, its margin darkened (fig. 89), veins yellowish. Abdominal terga and sterna reddish brown. Basal half of dorsal surface of the cerci light

brown, distal half and ventral surface dark brown. Coxae and most of the femoral surface reddish brown, apices of the femora (figs. 84-86), tibiae and tarsi dark brown.

Measurements (mm) (♀ in parentheses). – Length, 13.5 (13.5-14.7); pronotum length  $\times$  width, 3.6-4.0  $\times$  4.3-4.6 (4.0-4.1  $\times$  4.6-5.0); interocular width, 0.7-0.9 (1.1-1.2).

Remarks. – The shape of the female's subgenital plate of *reversa* resembles that of the female of *Haplosymploce nigra* (= *ferruginea*; see Roth, 1985b: fig. 11C).

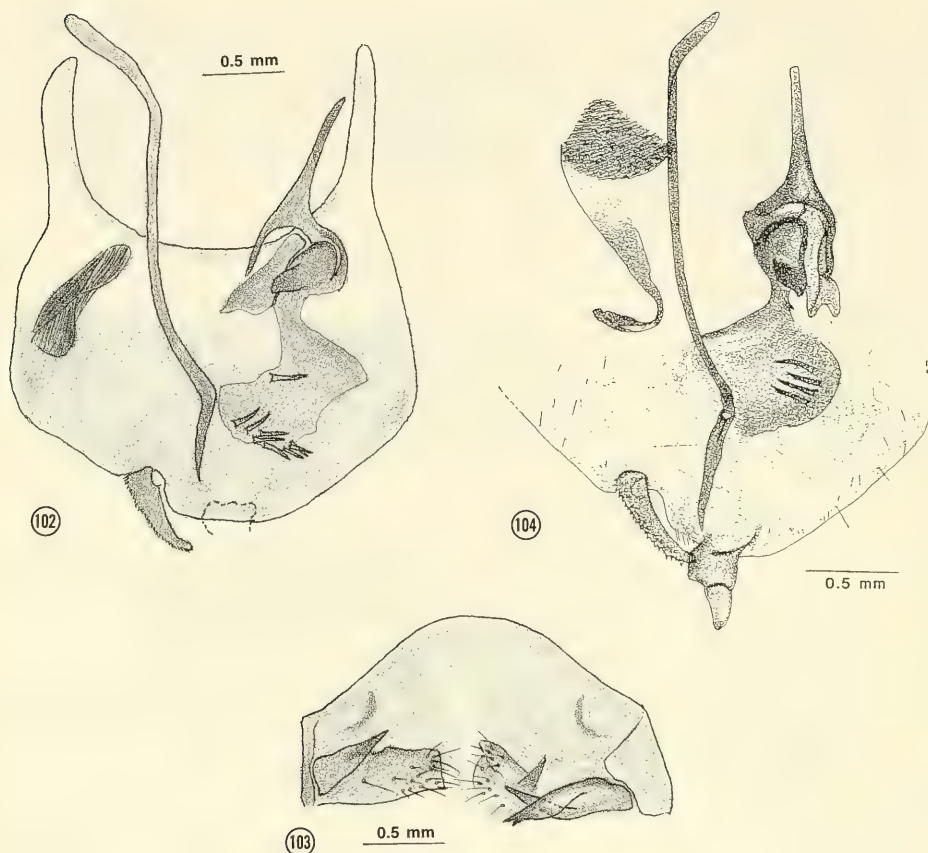
*Haplosymploce andamanica* (Princis) comb. n.  
(figs. 93-101)

*Mopsera andamanica* Princis, 1951: 59, pl. 6, fig. 64 (male & female).

*Pseudothyrocera andamanica* (Princis). – Princis 1969: 956.

Specimens examined. – Holotype ♂ (terminalia slide 111), Port Blair, Andaman Islands, Roepstorff; in ZMUC. Paratype. Andaman Islands. ZMUC: 1 ♀, same data as holotype.

Redescription. – Male: Head surface rough and with small setae, interocular width the same as the distance between antennal sockets; fifth maxillary palpomere distinctly longer than the fourth. Pronotum suboval, widest behind the middle, surface densely punctate and punctulate, and covered with small setae (fig. 93). Tegmina and wings fully developed extending beyond the end of the abdomen, the former with longitudinal discoidal sectors. Hind wings with subcosta extending to about the middle of the anterior margin, costal veins thickened, not clubbed, radial and media veins simple, cubitus vein weakly curved, with four complete and two incomplete branches, apical triangle absent (fig. 98). Front femur Type B, with 7 large proximal spines; pulvilli on four proximal tarsomeres, tarsal claws simple, symmetrical, arolia very small. First abdominal tergum medially with a pair of raised ridges and a deep fossa, and two groups of setae originating along the anterior margin and overlapping the fossae; a pair of filamentous membranes, apparently arising from the posterior margin of the metanotum extends to the first abdominal tergum (fig. 96). Seventh abdominal tergum with a deep medial fossa in which are a dense, group of curved setae (figs. 97). Supraanal plate appears to be trapezoidal, in the pinned specimen, because the hind margin is deflexed ventrad (fig. 99); in the slide preparation the hind margin is convexly rounded (fig. 95) with long setae along the hind margin; a pair of similar intercercal processes are spinelike



Figs. 102-104. *Beybienkoa guttifera* (Walker). 102-103, male holotype: 102, subgenital plate and genitalia (dorsal; the left hooklike phallomere and right style are missing); 103, supraanal plate and paraprocts (ventral); 104, male subgenital plate and genitalia, from near Mt Tozer, Queensland, Australia (dorsal) (from Roth, 1991, fig. 64A, as *Beybienkoa papuensis*).

and have a small spine apically; right and left paraprocts are dissimilar, each consisting of a stout curved sclerite the right one bearing seven stout spines apically and the left one with three apical spines (fig. 95). Subgenital plate asymmetrical, the hind margin to the left of the midline excavated, with a pair of dissimilar styles separated by the width of the excavation, the right style larger (figs. 94, 100). Genitalia as in fig. 100: hook on the left side with a preapical incision, and surrounded by a spicular membrane; near the hook is a dense, dark group of setae; median phallomere a slender, apically acute rod, above it is a dense group of dark setae near the apex; right phallomere with three sclerites one of which is a cleft.

Female: Interocular width slightly greater than in male. Front femur Type B<sub>1</sub>. Supraanal plate strongly trigonal, apex acute (fig. 101).

Colour. — Head black, only the clypeus and mouthparts partly brownish; maxillary palpomeres blackish; basal segments of the antennae blackish, remainder brownish yellow. Pronotal disk with a solid dark macula completely surrounded by pale orange yellow (fig. 93). Tegmina dark reddish brown. Hind wing hyaline, without infuscation, veins brownish. Abdominal terga with middle segments orange yellow, distal terga dark brown. Abdominal sterna with proximal segments orange yellow, distal segments blackish brown. (Female hind margin of subgenital plate orangish). Coxae and legs blackish brown.



Measurements (mm) (♀ in parentheses). – Length, 13.5 (12.0); pronotum length  $\times$  width,  $3.4 \times 4.3$  ( $3.7 \times 4.4$ ); tegmen length, 14.0 (14.0); interocular width, 0.5 (0.7).

Remarks. – Princis (1969: 956) placed this species in *Pseudothyrsocera*. However, the hind wing venation, subgenital plate, styles, and intercercal processes, are similar to those structures in species of *Haplosymploce*, and I am transferring *andamanica* to this genus.

### *Haplosymploce curta* (Hanitsch)

*Symploce curta* Hanitsch, 1932c: 264 (female).

*Haplosymploce curta* (Hanitsch). – Hanitsch 1933a: 128; Bruijning 1947: 218; Princis 1969: 876.

Holotype (not examined), ♀, Mampoe-grot (Mampoe cave), S. Celebes, S. Leefmans, ix.1929; the type is supposed to be in the Leyden Museum, but according to Bruijning (1947: 218) it is not there and probably is in the collection of the Buitenzorg Museum (now Museum Bogor).

Description (from Hanitsch 1932c). – Female: Head exposed, interocular space as wide as the distance between antennal sockets. Pronotum sub-orbiculate, anterior margin straight to weakly emarginate, hind margin obtusely produced. Tegmina short, reaching to the middle of the supraanal plate: 11 costals, the ninth and eleventh forked, the tenth four-branched; radial vein simple, discoidal sectors longitudinal. Wings as long as the tegmina, subcostal vein bifurcate; 8 costals, radial and media veins straight, simple, cubitus vein with three complete and two incomplete branches, apical triangle absent. Front femur Type A. Supraanal plate trigonal, keeled.

Colour. – Head dull orange, antennae rusty reddish brown. Pronotal disk dull orange, margins darker. Tegmina golden amber. Wings faintly orange, costal and apical regions dark orange. Cerci dull orange. Abdominal sterna dull reddish orange. Legs dull brownish yellow.

Male: Unknown.

Measurements (mm). – Total length, 11.0; pronotum length  $\times$  width,  $4.0 \times 4.3$ ; tegmen length, 8.8.

Remarks. – Until the male is found I am provisionally retaining the species in *Haplosymploce* because its cubitus vein of the hind wing has three complete branches and its front femur is Type A.

### ? *Haplosymploce castanea* (Brunner) comb. n.

*Phyllodromia castanea* Brunner, 1898: 204, pl. 16, fig. 7

(male). – Kirby 1904: 93; Shelford 1908a: 13; Hanitsch 1923: 402.

? *Mopsera castanea* (Brunner). – Hebard 1929: 78; Bruijning 1948: 98.

? *Pseudothyrsocera castanea* (Brunner). – Princis 1969: 956.

Holotype (not examined), ♂, Brunei, Borneo; supposedly in Brunner's collection in NMWA but it is not there (Kaltenbach, personal communication).

Description (from Brunner). – Male: Reddish brown. Vertex exposed, the front rusty red brown. Pronotum elongate, lateral margins pale. Marginal field of the tegmen brownish yellow. Wing not very infumate. Cubitus vein of hind wing with four branches. Legs and abdomen reddish brown.

Measurements (mm). – Body length, 11.0; pronotum length  $\times$  width,  $3.0 \times 3.3$ ; tegmen length, 10.5.

Remarks. – Brunner's meagre description is not sufficient to place *castanea* in *Pseudothyrsocera* unequivocally. I am provisionally placing it in *Haplosymploce* because the cubitus vein of the hind wing has four (?complete) branches.

### Distribution of *Haplosymploce* by species:

*andamanica*: Andaman Islands

*bicolor*: Sarawak

? *castanea*: Brunei

*curta*: Sulawesi

*montis*: Sabah; Sarawak; Sumatra

*moultoni*: Sarawak

*nigra*: Mentawai Island; Sabah; Sumatra; West Malaysia

*pica*: Singapore, Sumatra

*reversa*: Singapore; West Malaysia

*ruficollis*: Malaysia

### Distribution of *Haplosymploce* by country or region:

Andaman Islands: *andamanica*

Brunei: ? *castanea*

Malaysia: *ruficollis*

Mentawai Islands: *nigra*

Sabah: *montis*, *nigra*

Sarawak: *bicolor*, *montis*, *moultoni*

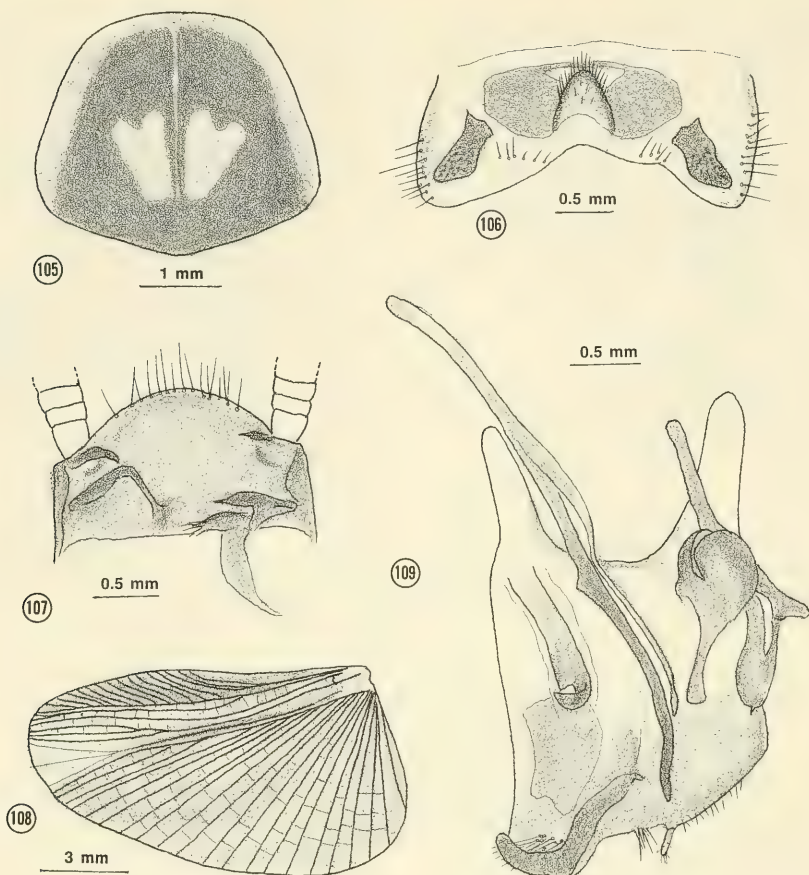
Singapore: *pica*, *reversa*

Sulawesi: ? *castanea*, *curta*

Sumatra: *nigra*, *pica*

West Malaysia: *nigra*, *reversa*

The following two species, *Blatta guttifera* and *Blatta walkeri*, which were listed by Princis (1969: 875, 876) under *Haplosymploce* belong in two different genera and are redescribed here as new combinations:



Figs. 105-109. *Hemithyrsochera walkeri* (Princis), male holotype of *Blatta elegans* Walker: 105, pronotum; 106, seventh abdominal tergum showing the medial gland and lateral lobes; 107, supraanal plate, subobsolete intercercal processes, and paraprocts (ventral); 108, hind wing; 109, subgenital plate and genitalia (dorsal).

*Beybienkoa guttifera* (Walker) comb. n.  
(figs. 102-104)

*Blatta guttifera* Walker, 1868: 230 (male).

*Phyllodromia guttifera* (Walker). – Kirby 1904: 93;  
Shelford 1907: 493, 1908a: 14.

*Haplosymploce guttifera* (Walker). – Princis 1969: 875.

*Symploce papuensis* Roth 1985d: 300, figs. 1A-J (male). Syn.  
n.

*Beybienkoa papuensis* (Roth). – Roth 1991: 656, figs. 64A-C  
(male & female).

Specimen examined. – Holotype, ♂ (terminalia slide 302), Aru Island [Moluccas], Mr. Saunders coll.; Type Orth. 97 in HECO. [the type is in very poor condition].

Remarks. – Unfortunately the hind wings are badly damaged, the right style and hook left phallomere are missing from the type (fig. 102). However, this species so closely agrees with the description of *Symploce papuensis* (Roth 1985d: 300) and later its new combination *Beybienkoa papuensis* (Roth 1991: 656) (from Papua New Guinea and Queensland, Australia), that I am synonymizing the two species. Similarities are found in the pronotum and head markings (see figs. 1A, B in Roth, 1985d), the supraanal plate and paraprocts (fig. 103), subgenital plate and left style (right style broken off); cf. figs. 102 and 104. There is only a minor difference in the right genital phallomere, one of whose sclerites in *papuensis* has four spines (fig. 104), whereas there are nine in *guttifera* (fig. 102), but I consider this in-

traspecific variation. The hind wing cubitus vein of *papuensis* has two long complete and zero to one incomplete branches, apical triangle distinctly developed (fig. 1J in Roth, 1985d).

*Hemithyrocera walkeri* (Princis) comb. n.  
(figs. 105-109)

*Blatta elegans* Walker (nec Eschscholtz, 1822) 1868: 226 (male).

*Phyllodromia elegans* (Walker), Kirby 1904: 92; Shelford 1907: 492, 493, 1906: 13; Hanitsch 1915: 55, 1923: 463.

*Parasymphloe elegans* (Walker). – Hebard 1929: 10.

*Haplosymphloe walkeri* Princis 1969: 876.

Specimen examined. – Holotype, ♂ (terminalia slide 303), Sarawak, Wallace, in Mr. Saunder's coll.; Type Orth. 95 in HECO.

Redescription. – Male: Head with interocular space distinctly less than the distance between antennal sockets. Pronotum suboval, hind margin produced (fig. 105). Tegmina and wings fully developed extending beyond end of abdomen, the former with a branched radial vein and longitudinal discoidal sectors. Hind wing with simple costal veins, radial vein branched before the middle, media and cubitus veins deeply concave, the latter with two complete and no incomplete branches, apical triangle well developed (fig. 108). Front femur Type A<sub>3</sub>; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, apparently with subobsolete serrations, arolia present. First abdominal tergum unspecialized. Seventh abdominal tergum with a medial setose gland and dark, well developed lateral lobes (fig. 106). Supraanal plate hind margin convexly rounded, entire; intercercal processes greatly reduced; right and left paraprocts dissimilar (fig. 107). Subgenital plate asymmetrical with a small cylindrical right style, and on the left side a large, darkly sclerotized, curved structure (possibly a left style) (fig. 109). Genitalia as in fig. 109: hook on the left side, without a preapical incision; median phallomere a stout rod with a slender filament arising from its upper third, right phallomere consisting of two large sclerites one of which is a cleft structure.

Female: Unknown.

Colour. – Head brownish yellow with a dark band on the vertex; last maxillary palpomere, and antennae dark. Pronotum with a pair of large dark bands very narrowly separated medially, and with two large brownish yellow maculae on the posterior half, lateral and anterior borders brownish yellow (fig. 105). Tegmina reddish brown. Hind wings infuscated, costal area darker (fig. 108). Legs brownish yellow. Cerci brownish.

Measurements (mm). – Length, 10.6; pronotum

length × width, 3.1 × 3.7; tegmen length, 13.0; interocular width, 0.4.

Remarks. – Hebard (1929: 10) listed this species (and three others) in a table as ‘... *elegans*’. Princis (1969: 876) assumed he placed them in *Parasymphloe* because several taxa listed before them were placed in that genus. If he meant the dots to represent *Parasymphloe*, he was correct because *Parasymphloe* is a junior synonym of *Hemithyrocera* (Roth 1995: 962). The gland and lateral lobes of the seventh tergum, wing venation and distinct apical triangle, subgenital plate and genitalia of *walkeri* are typical of *Hemithyrocera* (= *Parasymphloe*), and the species clearly is not a *Haplosymphloe* as claimed by Princis. The subobsolete serrations on the tarsal claws is unusual for the genus.

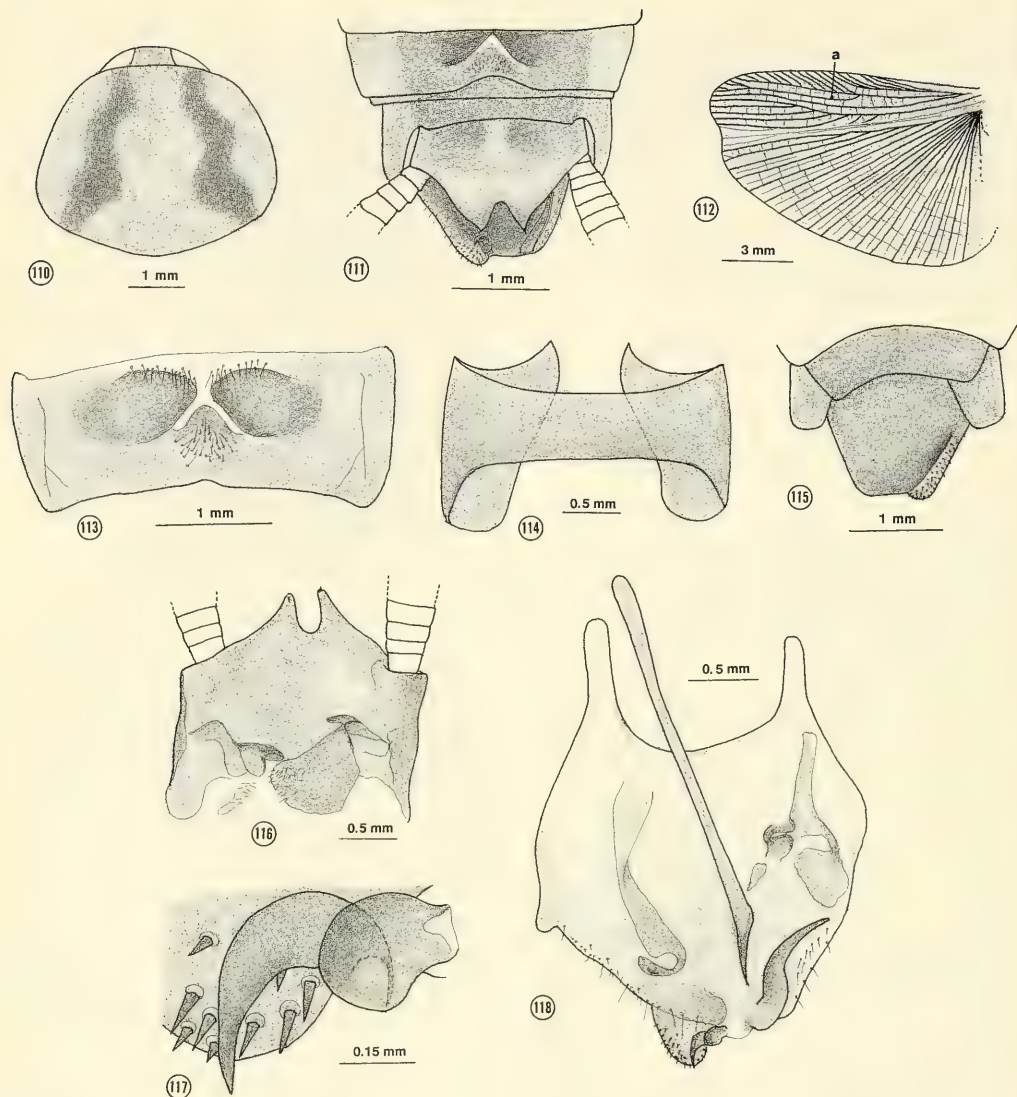
### New combinations, new species, and new records of *Episymphloe*

Genus *Episymphloe* Bey-Bienko

*Episymphloe* Bey-Bienko, 1950: 157; Asahina, 1979: 352; Roth, 1986b,: 355; 1986c: 173; 1987a: 455; 1987b: 111; 1987c: 125; 1987d: 143 (generic revision, new species).

Diagnosis. – Tegmina and wings fully developed (rarely with reduced tegmina and wings in the female), the former with longitudinal discoidal sectors. Hind wing with radial vein usually branched before or after the midpoint; cubitus weakly or distinctly curved with one to seven (rarely none) complete branches, and none to seven incomplete rami, apical triangle subobsolete or absent (fig. 112). Anteroventral margin of front femur Type A<sub>1</sub>, B<sub>1</sub> (rarely B<sub>2</sub>), or intermediate between the two types; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia present. Male: First abdominal tergum with or without a gland. Seventh abdominal tergum always specialized (figs. 111, 113). Supraanal plate often asymmetrical, the hind margin may be invaginated, excised (fig. 116), sometimes entire, or with a symmetrical or asymmetrical process (fig. 120); right and left paraprocts dissimilar; intercercal processes absent (figs. 116, 120). Subgenital plate asymmetrical, often trigonal with the left (figs. 111, 115), or right and left sides setose and incrassate (the thickened region may vary in length, and sometimes is absent); usually there is a spinelike process on each side about midway on the lateral margin, these differing in length on the right and left sides (these are similar to subgenital plates of the *lugubris*-species-group of *Pseudothyrocera*; see fig. 47). Two similar or dissimilar styles usually occur on the apical end of the subgenital plate (fig. 118). Genitalia consisting of





Figs. 110-118. *Episymphloe simmonsii* sp. n., male paratype: 110, pronotum; 111, abdominal terga seven to ten, and subgenital plate (dorsal); 112, hind wing (a, posterior branch of the radial vein); 113, seventh abdominal tergum; 114, ninth abdominal tergum and laterotergites (dorsal; the laterotergites are turned under the tergum); 115, eighth abdominal sternum, ninth laterotergites, and subgenital plate (ventral); 116, supraanal plate and paraprocts (ventral); 117, left style and thickened corner of the subgenital plate; 118, subgenital plate and genitalia (dorsal).

three phallomeres, the hook occurring on the left side (fig. 118), placing the genus in the Blattellinae.

Remarks. — The hind wing venation of *Haplosymphloe* is similar to that of *Episymphloe* except that its radial vein is unbranched (or has a pseudoposterior branch). Also the former genus has intercercal

processes which are lacking in *Episymphloe*.

In my revision of *Episymphloe* (Roth, 1987a: 150) I described and redescribed 53 species. In this paper I describe two new species and transfer some species of *Symphloe*, raising the total number in the genus to about 70.

*Episymploce simmonsii* sp. n.  
(figs. 110-118)

Specimens examined. – Holotype, ♂, Indonesia, Sulawesi, Tengah, Gng., Sinsing, above Sinsing Camp, SW. of Luwuk, understory/canopy lowland rainforest at light, 200 m, Sample Sul. 16, 16.x.1989, J.P. Duffels; in ZMAN. Paratypes: Sulawesi. ZMAN: Indonesia, Sulawesi Tenggara, Centipede Camp, nr. Gng. Watowila, NE. of Kolaka, c. 3°49'S 121°40'E, canopy undisturbed hilly rainforest at light, 1100 m, Sample Sul. 31, 1 ♂ (terminalia slide 47), 2.xi.1989, Sample Sul. 34, 1 ♀, 5.xi.1989, J.P. Duffels.

Description. – Male: Head slightly exposed, interocular space the same as distance between ocellar spots. Pronotum suboval (fig. 110). Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal discoidal sectors. Hind wing with five subcostal veins and ten simple costal veins, radial vein with a branch originating before the middle, terminating in one forked and one simple branch; media and cubitus veins concave the former simple, the latter with four complete and two small incomplete branches, apical triangle subobsolete (fig. 112). Front femur Type A<sub>3</sub>; pulvilli on four proximal tarsomeres of all legs, tarsal claws simple, symmetrical, arolia small. First abdominal tergum with a row of setae along an anterior ridge and a few setae anteromedially. Seventh abdominal tergum with a pair of deep, dark fossae anteromedially, with a row of setae along the anterior margins of the depressions; between the fossae is a triangular elevation bearing a group of setae (figs. 111, 113). Right and left ninth laterotergites similar, ventral margins without dark setae (fig. 114). The supraanal plate hind margin has a U- or V-shaped medial excavation forming a pair of lobes that do not reach the hind margin of the subgenital plate if their apices are deflexed (holotype, fig. 111); in the paratype the lobes are not deflexed and their tips reach the hind margin of the plate; each lobe has a minute dark terminal spine; intercercal processes absent; right and left paraprocts dissimilar, the right one with a small sclerotized, apically rounded process and a large, more lightly sclerotized plate, left paraproct with a darkly sclerotized plate (figs. 111, 116). Subgenital plate asymmetrical the hind margin truncate, left side roundly thickened or swollen and bearing minute spicules or spines; styles, which are not visible in ventral view (fig. 115), are strongly dissimilar, the right one large, spinelike, lying pressed against the right side of the plate, left one much smaller, corkscrew shaped, arising near the base of the swollen margin (figs. 111, 115, 117, 118). Genitalia as in fig. 118; hook on the left side with a preapical incision, median phallomere a slender rod,

its apex darkly sclerotized and acute, right phallomere consisting of about four sclerites one of which is a small cleft.

Female: Supraanal plate convexly rounded. Branch of radial vein of hind wing terminally forked.

Colour. – Head yellowish brown without markings, labrum darker; maxillary palpomeres two and three pale, segments four and five dark brown. Pronotum with a pair of irregular, oblique blackish stripes that reach the anterior and posterior borders, background colour yellowish brown (fig. 110). Tegmina without markings, hyaline, light brown, humeral area lighter. Hind wing infuscated (fig. 112). Abdominal terga brown with yellowish lateral borders, fossae on abdominal tergum seven black; in the holotype, the supraanal plate has a pair of dark round maculae anteromedially (fig. 111), which is absent in the paratype, remainder yellowish brown. Abdominal sterna and legs light brown. Cerci light brown dorsally, darker ventrally.

Measurements (mm) (♀ in parentheses). Length, 13.5-14.0 (12.8); pronotum length × width, 3.1-3.4 × 3.8-4.1 (3.0 × 3.7); 14.0-14.2 (12.7); interocular space, 0.4-0.6 (0.8).

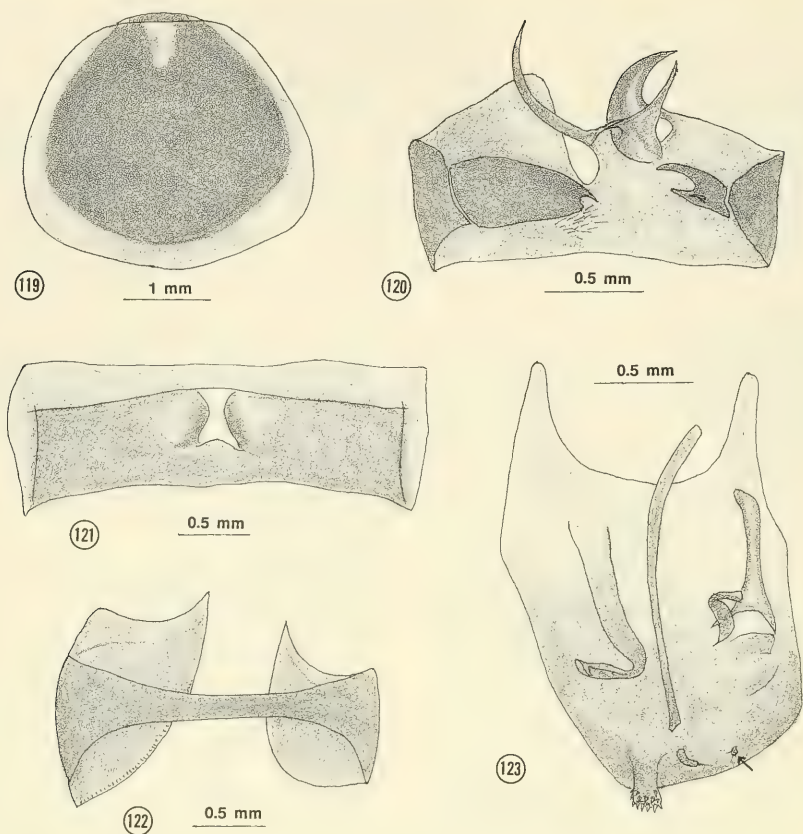
Etymology. – The species is dedicated to Dr. Emory Simmons, mycological taxonomist, friend, and former colleague at the U.S. Army Research and Development Laboratories, Natick, MA.

Remarks. – Compared with the other known species on Sulawesi, the subgenital plate, and styles of *simmonsii* come closest to those of *Episymploce sulawesensis* Roth (cf. figs. 117-118 with figs. 6C, E, in Roth 1986c). The two species differ strongly in their pronotal markings, and shapes of the supraanal plate and ninth laterotergites (cf. figs. 110, 111, 114, 116, with figs. 6A, B, G in Roth, 1986c).

*Episymploce parafissa* sp. n.  
(figs. 119-123)

Specimen examined. – Holotype ♂ (terminalia slide 50), Indonesia, Sulawesi, Tengah, Totop camp along Batui river, 1°09'S 122°31'30"E SW. of Luwuk, Sample Sul. 21, understory/canopy lowland rainforest, at light, 120 m, 21.x.1989, J.P. Duffels; in ZMAN.

Description. – Male: Head hidden, interocular space greater than distance between ocellar spots. Pronotum suboval (fig. 119). Tegmina and wings fully developed extending beyond end of abdomen, the former with longitudinal discoidal sectors. Hind wing with simple, thickened costal veins, radial vein with an apically forked branch arising near the middle,



Figs. 119-123. *Episymptloce parafissa* sp. n., male holotype: 119, pronotum; 120, supraanal plate and paraprocts (ventral); 121, seventh abdominal tergum; 122, ninth abdominal tergum and laterotergites (dorsal; the laterotergites are folded under the tergum); 123, subgenital plate and genitalia (dorsal; the arrow indicates the subobsolete right style).

media vein simple, cubitus vein with two complete and three incomplete branches, apical triangle small. Front femur Type A; pulvilli on four proximal tarsomeres, tarsal claws symmetrical, simple, arolia small. First abdominal tergum unspecialized. Abdominal tergum seven with a pair of shallow, non-setose depressions separated by a clear longitudinal zone (fig. 121). Supraanal plate strongly asymmetrical, hind margin deeply excavated forming two lobes, the right one terminating as a stout spinelike process and two dissimilar spinelike processes arising on the ventral surface; intercercal processes absent; paraprocts dissimilar sclerotized plates, the left one larger (fig. 120). Ninth laterotergites dissimilar, the left one larger and with a fringe of minute spicules along the ventral margin, these absent from the smaller right

plate (fig. 122). Subgenital plate asymmetrical with a small apically spined structure protruding from the hind margin and to its right a very small left style and a subobsolete right style; midlateral margins of the plate without processes (fig. 123; both styles are not visible ventrally in the pinned specimen and the right style can be detected under high magnification in the slide preparation). Genitalia as in fig. 123: hook on the left side, with a preapical incision; median phallosome a curved simple rod, apex blunt; right phallosome consisting of at least two distinct sclerites one of which is a reduced cleft.

Colour. — Head black, ocellar spots whitish, clypeus and labrum pale; maxillary palpi and antennae black. Pronotum blackish with a broad yellow border laterally and posteriorly and a small yellow



mark anteriorly (fig. 119). Tegmina dark reddish brown with a yellow band along the subcostal region and along about two thirds the length of the costal zone. Abdominal terga dark brown, the lateral borders yellow. Supraanal plate reddish brown with a yellowish spot on the distal margin of each lobe on either side of the excavation. Abdominal sterna brown, yellow along the lateral margins. Legs dark brown.

Female. Unknown.

Measurements (mm). – Length, 9.7; pronotum length  $\times$  width,  $3.0 \times 3.5$ ; tegmen length, 10.5; interocular width, 0.8.

Remarks. – The pronotal markings of *parafissa* are similar to those of *fissa* (cf. fig. 119, with fig. 9A in Roth 1986c) and both have the hind margin of the supraanal plate deeply excavated (cf. fig. 120, with fig. 9B in Roth, 1986c). Although there are distinct specific differences in the styli, detailed structure of the supraanal plate and paraprocts, and the ninth laterotergites, indicate that these two species are closely related.

The following species of *Symploce* are transferred to *Episymploce*; I had placed these in *Symploce* because they have symmetrical supraanal plates, without modified hind margins. One of the characters used to separate *Episymploce* from *Symploce* was an asymmetrical plate, or if symmetrical its hind margin was excised or showed some modification. However, I now believe that some species may have symmetrical, unmodified supraanal plates, and belong in *Episymploce*, provided other features (especially the subgenital plate, styles, and wing venation) are characteristic of the genus.

*Episymploce falcifera* (Hanitsch) comb. n.

*Ischnoptera falcifera* Hanitsch, 1925: 81, figs. 4, 5.

*Symploce falcifera* (Hanitsch). – Hebard 1929: 10; Roth 1985a: 456, figs. 1A-J. [Sarawak].

*Episymploce juxtafalcifera* (Roth) comb. n.

*Symploce juxtafalcifera* Roth, 1985a: 459, figs. 2A-J, 3A-I. [Borneo, Philippines, Singapore].

*Episymploce tibangensis* (Roth) comb. n.

*Symploce tibangensis* Roth, 1985a: 460, figs. 4A-J. [Sarawak].

*Episymploce busuangensis* (Roth) comb. n.

*Symploce busuangensis* Roth, 1985a: 461, figs. 5A-K [Philippines].

*Episymploce talinasensis* (Roth) comb. n.

*Symploce talinasensis* Roth, 1985a: 464, figs. 6A-I. [Philippines].

*Episymploce torrevillasi* (Roth) comb. n.

*Symploce torrevillasi* Roth, 1985a: 464, figs. 7A-J, 8A-G [Philippines].

*Episymploce telephoroides* (Walker) comb. n.

*Blatta telephoroides* Walker, 1871: 23.

*Allacta telephoroides* (Walker). – Kirby 1904: 100.

*Phyllodromia telephoroides* (Walker). – Shelford 1908a: 12.

*Gislenia telephoroides* (Walker). – Princis 1959: 125 (incorrectly synonymized with *Blatta brevipes* Walker).

*Symploce telephoroides* (Walker). – Roth 1985a: 468, figs. 9A-I [India].

*Episymploce dispar* (Princis) comb. n.

*Symploce dispar* Princis, 1957: 147, fig. 14. – Roth 1985a: 468, figs. 10A-M. [Flores].

*Episymploce forficula* (Bey-Bienko) comb. n.

*Symploce forficula* Bey-Bienko, 1957: 906. – Roth 1986a: 379, figs. 3A-I. [China, Thailand].

*Episymploce perakensis* (Roth) comb. n.

*Symploce perakensis* Roth, 1986a: 379, figs. 4A-G. [West Malaysia].

*Episymploce quadripunctata* (Hanitsch) comb. n.

*Phyllodromia quadri-punctata* Hanitsch, 1915: 57, pl.1, fig. 1.

'*Phyllodromia*' *quadripunctata* Hanitsch. – Hebard 1929: 11.

*Symploce quadripunctata* (Hanitsch). – Princis 1969: 886; Bruijning 1948: 83; Roth 1986a: 386, figs. 8A-G, 9A-E (redescription).

*Episymploce bipinnacula* (Roth) comb. n.

*Symploce bipinnacula* Roth, 1986a: 389, figs. 10A-I. [South Vietnam].

*Episymploce ligulata* Bey-Bienko

*Episymploce ligulata* Bey-Bienko, 1957: 911, fig. 12.

*Symploce ligulata* (Bey-Bienko). – Roth 1985c: 214, 1986a: 391, figs. 12A-J. [China, Thailand].

*Episymploce popovi* Bey-Bienko

*Episymploce popovi* Bey-Bienko, 1957: 910.

*Symploce popovi* (Bey-Bienko). – Roth 1985c: 214, 1986a: 394. [China].

*Episymptloce marginata* Bey-Bienko*Episymptloce marginata* Bey-Bienko, 1957: 911.*Symptloce marginata* (Bey-Bienko). – Roth 1985c: 214, 1986a: 394.

## NEW RECORDS

*Episymptloce sundaica* (Hebard)*Symptloce sundaica* Hebard, 1929: 64, pl. 4, fig. 5, pl. 5, fig. 2 (male & female).*Episymptloce sundaica* (Hebard). – Roth 1985c: 214, 1986b: 365, figs. 7-13 (synonymy and redescrptions male & female).

Specimen examined. – Sabah. RMNH: N. Borneo, 16 km NE. of Tenom, orchid garden surr. by plantations, 180 m, 1♂, 06-1986, J. Huisman. Philippine Islands. ANSP: Zambalea Province, Luzon, 2♂, 1♀, xii.1917, W. Boettcher.

Remarks. – *Episymptloce sundaica* is a very widely distributed species with at least seven synonyms. The type is from Sumatra but the species is found in Java, Kalimantan (East Borneo), Laos, Okinawa, Papua New Guinea, possibly Sulawesi (Celebes), Thailand, and Taiwan; in Sabah, it was previously reported from Sensuron (Roth 1986b: 371-373).

*Episymptloce malaisei malaisei* (Princis)*Symptloce malaisei* Princis, 1950b: 217, figs 14, 15 (male & female).*Episymptloce malaisei malaisei* (Princis). – Roth 1987c: 136, figs. 3A-K (redescription).

Specimen examined. – Burma. ANSP: Myitkyina, Upper Burma, at tent lights or environs of town, 1♂, 10.vi.1945, J.W.H. Rehn.

Remarks. – This subspecies also is found in China.

*Episymptloce suknana* Roth*Episymptloce suknana* Roth, 1987b: 119, figs. 6A-J (male).

Specimens examined. – India. MCZC: Alagar hill, about 16 km from the ancient temple city of Madurai, rainforest, about 900 m, 3♂ (one with terminalia in vial), 4♀, reared from nymphs (killed 26.vii.1994), A. Padmanabhan.

Measurements (mm) (♂ holotype in brackets; ♀ in parentheses). – Length, 18.5-20.0 [19.0] (19.4-22.5); pronotum length × width, 4.3-4.6 × 5.5-5.8 [4.6 × 6.1] (4.8-5.3 × 6.0-6.5); tegmen length, 17.5-18.1 [20.0] (19.0-20.5); interocular width, 0.6 (0.9).

Remarks. – This species was previously known from the unique male holotype from Sukna, 55 km south of Darjeeling. The specimens have a large black macula on the pronotum and the head is black except for the pale clypeus. The male supraanal and subgenital plates and genitalia agree well with those of the holotype.

According to Padmanabhan (personal communication), the nymphs of *suknana* are shiny black and rarely have a pair of orange spots on the pronotum. The immatures live in holes under stones. Adults also occur under stones and litter and rarely are seen on shrubs. Females carry their oothecae for two to three days before depositing them. Eggs hatch in 34 to 36 days.

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## REVISION OF THE GENUS

### *METAEUCHROMIUS* BLESZYNSKI

(LEPIDOPTERA: PYRALIDAE: CRAMBINAE)

Schouten, R. T. A., 1997. Revision of the genus *Metaeuchromius* Bleszynski (Lepidoptera: Pyralidae: Crambinae). – Tijdschrift voor Entomologie 140: 111-127, figs. 1-28. [ISSN 0040-7496]. Published 31 October 1997.

The species of the genus *Metaeuchromius* Bleszynski, 1960 are revised. *Metaeuchromius* is a senior synonym of *Pseudeuchromius* Bleszynski, 1965. *Pseudeuchromius latus* (Staudinger, 1870) and *Diptychophora euzonellus* Hampson, 1896 are transferred to *Metaeuchromius*. Three new species are described: *M. latoides* (Turkey), *M. changensis* (China) and *M. inflatus* (Nepal). Newly discovered scent organs on the male abdominal sternite are figured and described. A key is provided together with full (re)descriptions of all species, with notes on distribution and biology.

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Keywords. – Pyralidae; Crambinae; *Metaeuchromius*; key; new species; checklist; tympanal organs; abdominal scent organs.

*Metaeuchromius* was described as a monotypic genus for *Eromene yuennanensis* Caradja, 1937. Bleszynski (1965) described the second species of the genus, *Metaeuchromius circe*. *Eromene latus* Staudinger, 1870 was transferred to the genus *Pseudeuchromius* by Bleszynski (1965) and is now included in the genus *Metaeuchromius*. *Diptychophora euzonellus* Hampson, 1896 is here transferred to *Metaeuchromius*. *Metaeuchromius flavofascialis* Park, 1990 is the most recently described species. At the start of this study the genus comprised three species. In this article three new species are described and two species are transferred to *Metaeuchromius*.

Thus, the genus now contains eight species. *Metaeuchromius* has its main distribution in the eastern Palaearctic. Only *M. latus* and *M. latoides* occur in the more western part of the Palaearctic.

Bleszynski (1965) erected the monotypic genus *Pseudeuchromius* for *Euchromius latus* (Staudinger, 1870). Comparing the diagnoses given by Bleszynski (1965) of *Pseudeuchromius* and *Metaeuchromius* the following characters to distinguish *Pseudeuchromius* from *Metaeuchromius* are found: (1) The more or less closed cell of the hind wing; (2) The elongated apophyses.

Ad. (1) Upon checking various specimens of *Pseudeuchromius latus* I found that the cell of the hind wing in this species is also more or less closed. Ad. (2)

In my opinion the elongation of the apophyses is not a very strong character at the generic level. The elongated apophyses of *P. latus* can be regarded as an secondarily derived character to facilitate the deposition of eggs in narrow and relatively deep locations.

This together with the newly discovered abdominal scent organs, which are found in *P. latus*, *M. yuennanensis* (type species of *Metaeuchromius*) and several other species of *Metaeuchromius*, have made me decide to synonymize *Pseudeuchromius* with *Metaeuchromius*.

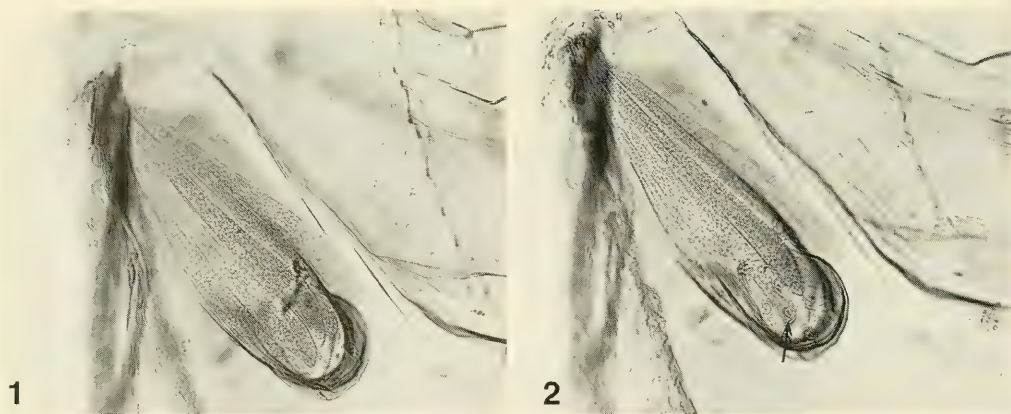
#### Material and methods

The formula for the black terminal dots mentioned in the species descriptions is read as follows; 2-2-3-2 stands for: the black terminal dots closest to the apex start with a group of two, followed by a second group of two dots, a group of three dots and finally a group of two dots near the tornus (fig. 7).

The spelling of the localities is taken literally from the labels as to make tracing of the material easier. For the Chinese material the equivalent in Pinyin transcription is given.

Distribution maps are based on personally examined material only.

The purpose of the key is to make identification as easy as possible, starting with external characters and,



Figs. 1-2. *M. euzonellus*. – 1, Specialized scales covering the opening of the abdominal scent organ. 2, 'Pits' (see arrow) in abdominal scent organ.

when unavoidable, followed by characters of the genitalia. Identification can be difficult or even impossible if the specimen is not in a good condition. In such cases the genitalia have to be checked.

The terminology of the tympanal organs follows Maes (1985).

Abbreviations for specimen depositories follow Arnett et al. (1993).

### *Metaeuchromius* Bleszynski, 1960

*Metaeuchromius* Bleszynski, 1960: 217. Type species: *Eromene yuennanensis* Caradja, 1937: 151.

*Pseudeuchromius* Bleszynski, 1965: 90. Type species: *Eromene lata* Staudinger, 1870: 204. Syn. n.

### Characteristics

The genus *Metaeuchromius* is externally very similar to *Euchromius* Guenée, 1845 and *Miyakea* Marumo, 1933. *Metaeuchromius* is in my opinion more closely related to *Miyakea* than to *Euchromius*. This in the light of *Miyakea* and *Metaeuchromius* sharing the rounded not forwardly protruding frons, the 'broad' fore wings, the absence of a sclerotized spinula and the apex of the gnathos directed upward. Both genera also share the closed cell of the hindwing.

Landry (1995) sets *Euchromius* and *Platytes* separate from the other Crambini as the most plesiomorphic group. This based on the synapomorphic character-state 11 (0): R5 of the forewing free from other radial veins. Both *Metaeuchromius* and *Miyakea* share this synapomorphy with them.

The character-states by which *Euchromius* and *Platytes* are placed in the Crambini are: character 15 (0): cell of the hindwing open; 27 (1): apex of the gnathos directed downward; 41 (1): papillae anales not coalesced.

Character-state 41 (1) is also found in *Metaeuchromius* and *Miyakea*. Character-state 15 (0) is not found in *Metaeuchromius* and *Miyakea* (the cell of the hind wing is closed), but I agree with Landry (1995: 37) this apomorphic character may have arisen independently. As regarding to character-state 27 (1) the same arguments may apply for *Metaeuchromius* and *Miyakea* as for *Ancylolomia* (Landry 1995: 44): 'the most parsimonious solution regarding character-state changes in this character is that the apomorphic state occurs once in the Crambini except *Ancylolomia* and independently in *Calamotropha*, *Evergestis* and *Scoparia*'. My conclusion based on the former paragraphs is: *Metaeuchromius* is more closely related to *Miyakea* than to *Euchromius*. A phylogenetic analysis is not within the scope of the present study. Therefore I make no comment of the relationship of *Metaeuchromius* within the Crambinae. To make a more scientifically thorough decision whether *Metaeuchromius* and *Miyakea* form a monophyletic group with *Euchromius* and *Platytes* two conditions must be fulfilled: A) both genera must be included in the cladistic analysis. B) The cladistic analysis must be carried out with a monophyletic group and not by using a geographical area with taxa whose monophyletic origin is highly disputable.

### External characters

*Metaeuchromius* has no character at genus level to distinguish it from *Miyakea* and *Euchromius*. For the description of wings patterns etc. refer to Schouten (1988).

### Male genitalia

The uncus is broad (except in *M. euzonellus*), ending in a sharp-pointed tip. Gnathos is simple hook-



shaped as long as the uncus. The tegumen has no special shapes or structures. Sacculus present or inconspicuous. Processus of sacculus absent. Processus inferior valvae absent. Processus basalis present or not, usually rounded. Cucullus oblong to elongated usually ending in a sharp-pointed tip. Juxta variable, v-shaped, rectangular or slender. Vinculum without any special structures. Aedeagus varying from short to long and slender, armed with many minute to one cornutus and cornuti small to large.

### Female genitalia

Papillae anales normal to small. Apophyses posteriores and anteriores short to very long. Ostium simple. Ductus bursae short or long, with or without sclerotization, with or without a pouch-shaped enlargement. Ductus seminalis slender. Bursa copulatrix rounded or oblong, with or without signa, or sclerotization.

### Tympanal organs

In *Metaeuchromius* the tympanum and conjunctivum make an angle and the bulla tympani are of the 'open' type. Consequently, *Metaeuchromius* has tympanal organs of the 'Crambidae' type, as defined by Minet (1982) and Maes (1985).

Description of the tympanal organs in *Metaeuchromius* (figs. 3, 4). – The praecinctorium is simple sac-shaped, no thorn-like sclerotization at the connection with the pons tympani. The bulla tympani are bean-shaped. The fornix tympani, supporting the conjunctivum, are well developed and clearly visible. The rami tympani are not connected, not forming a well defined semi-circle as in *Euchromius* and *Miyakea*. The sacci tympani are open and not very deep. The processi tympani vary in size, but are small to almost absent in *lata*. The processi tympani are dorsal-ventrally orientated and thus it is not always possible to measure their size. The spinula is not sclerotized. The venula prima, situated lateral to the fornix tympani, is always present. The venula secunda, posterior of the fornix tympani, is more or less an extension of the venula prima and not very well developed in some species.

### Abdominal scent organs

The presence of abdominal scent organs in Crambinae species was up to now unknown. Several species of *Metaeuchromius* i.e. *yuennanensis*, *changensis*, *circe*, *lata* and *euzonellus* have abdominal scent organs on sternite III of the males. The scent organs can be classified as type 5 as used by Scoble (1992). The type 5 scent organs consist of a group of scales which cover a separately located glandular area. The scales can be differentiated in various ways. The type 5 organs are found on various parts of the body e.g. legs, wings, abdomen. The type 5 scent organs have been

discovered on several families, Noctuidae, Nymphalidae and Sphingidae (Scoble 1992). The scent organs in males are generally believed to be used when a male is in close contact with a female.

### Diagnosis

(1) The dorsal insertion of the ductus ejaculatorius is subterminal; (2) The gnathos is simple, hook-shaped; (3) Sternite III of the males bear a more or less developed pair of 'scent organs' sometimes with specialized scales (except in *flavofascialis* and *inflatus*); (4) The frons is rounded; (5) M1 of the hindwing is located in the lower angle of the more or less closed cell; (6) The ramus tympani is not connected, thus not semicircular; (7) The saccus tympani is 'open' and small; (8) The spinula is not sclerotized.

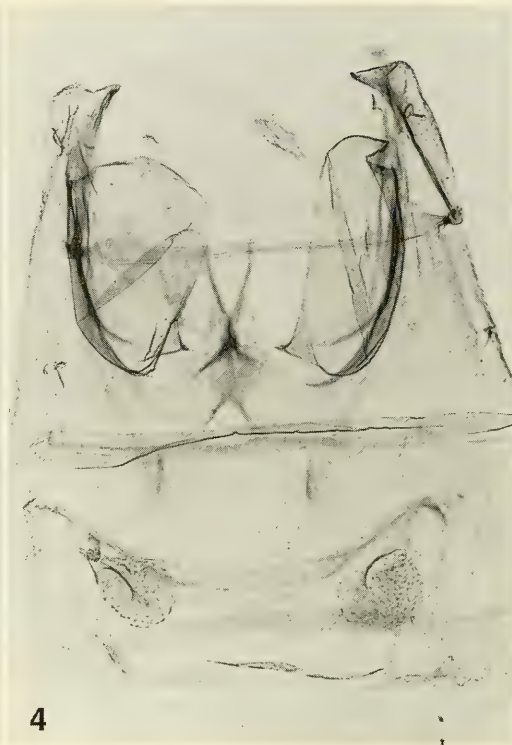
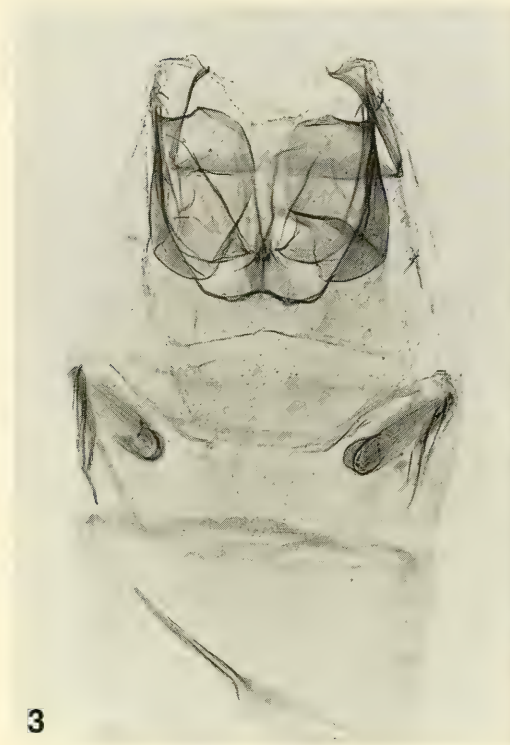
### Checklist of *Metaeuchromius* Bleszynski

*changensis* sp. n.  
*circe* Bleszynski, 1965  
*euzonellus* (Hampson, 1896) comb. n.  
*flavofascialis* Park, 1990  
*inflatus* sp. n.  
*latoides* sp. n.  
*latus* (Staudinger, 1870) comb. n.  
*yuennanensis* (Caradja, 1937)

### Key to the species of *Metaeuchromius* Bleszynski

The key can only be used when specimens are in a good condition. For a definite identification always check the genitalia.

1. Six, seven or eight black dots at termen of the forewing ..... 2  
 – Four to five black dots at termen of the forewing ..... *euzonellus*
2. Groundcolour of the forewing pure white, usually a clear dark brown to black spot in posterior area ..... *inflatus*  
 – Groundcolour of the forewing dirty to creamy white ..... 3
3. Medial fascia whitish ..... 4  
 – Medial fascia yellowish ..... 6
4. Males (male of *latoides* unknown) ..... *latus*  
 – Females ..... 5
5. Bursa copulatrix with one minute signum *latus*  
 – Bursa copulatrix without a signum ... *latoides*
6. Hindwing dark brown ..... *circe*  
 – Hindwing creamy white to grey or light grey-brown ..... 7
7. Medial fascia convex ..... *yuennanensis*  
 – Medial fascia straight ..... 8
8. Females (female of *flavofascialis* unknown) ...  
 ..... *changensis*



Figs. 3-4.— 3, *M. euzonellus*. Abdomen, ventral aspect showing the tympanal organs and the abdominal scent organs on sternite III. 4, *M. changensis*. Abdomen, ventral aspect showing the tympanal organs and the rounded scent organs on sternite III.

- Males ..... 9
- 9. Large group of cornuti on the vesica occupying two-thirds of the length of aedeagus (fig. 16) ..  
.....*changensis*
- vesica with a group of cornuti occupying less than one-third of the aedeagus (fig. 20) .....  
.....*flavofascialis*

*Metaeuchromius changensis* sp. n.  
(figs. 4, 6, 9, 12, 16)

Type-material. — Holotype: ♂, 'Chang Yang A.E. Pratt Coll. May 1888', GS 17849. Paratypes: 2 ♂, 'Chang Yang A.E. Pratt Coll. June 1888', GS 17854, other male without abdomen. 2 ♂ 1 ♀, 'Siang-yang-fu [=Xiangfan] China W. 5000ft /93', without abdomen. All type-material in BMNH.

Diagnosis. — Externally very similar to the other species in the genus. Differs in male genitalia (female genitalia unknown) in having asymmetrical valvae in

combination with the aedeagus as long as or longer than the length of the larger valve.

External characters (fig. 12). — Wingspan 14-17 mm. Frons not produced forward, creamy white, dark brown centre; vertex creamy white to brown; the length of the labial palp is two to two and a half times the eye diameter, sides brown becoming lead-grey, grey from above, creamy white from below; maxillary palp brown, terminal part creamy white; on antenna creamy white, inconspicuous darkly ringed. Thorax brown; patagia brown; tegulae brown, inner side lined creamy white. Forewing, groundcolour creamy white densely suffused with ochreous to dark brown scales, posterior area with one, more or less clear, dark brown spot; medial fascia straight, running to one-third of the dorsum; subterminal line brown-grey, about midway between terminal dots and termination of posterior area; area adjacent to terminal black dots white; seven black terminal dots, formula 2-3-2; fringes shiny evenly grey. Hindwing light to dark grey, subterminal fascia present, termen darkly bor-

dered; fringes creamy white with darker line.

Abdomen (figs. 4, 6). — Scent organs incorporated in the abdomen, roundish, kidney-shaped, small opening laterally directed. Wall of scent organs with pits. No special scale formation observed in relation to the scent organs.

Male genitalia (fig. 16). — Uncus normal, tapering to sharp pointed tip; gnathos equal in length, dorsal thorns absent; valvae asymmetrical, sacculus slender in one valve, normal in the other, processus basalis small somewhat rectangular, cucullus ending in bent pointed tip, unequal in size; juxta oblong; vinculum normal; aedeagus as long as or longer than length of larger valve, with many cornuti, total length of cornuti shorter than length of aedeagus.

Female genitalia. — Unknown, the only available female specimen lacks an abdomen.

Biology. — Unknown. Specimens caught in May and June. Found at an altitude of 1650 m.

Distribution (fig. 9). — Eastern part of China.

*Metaeuchromius circe* Bleszynski, 1965

(figs. 10, 14, 18, 23)

*Metaeuchromius circe* Bleszynski, 1965: 87. Holotype: ♂, 'Kwansien F.7.30', GS 7251 BM. BMNH.

Material. — 1♂ 4♀. China: Changyang, 1♀ (BMNH); Kwansien, 1♂ 1♀ (BMNH); Siang-yang-fu [=Xiangfan], 2♀ (BMNH).

Diagnosis. — Differs from all other species in having dark brown wings in combination with a wingspan of 14–16 mm.

External characters (figs. 14). — Wingspan 14–16 mm. Frons not produced forward, mingled creamy white with brown, vertex creamy white to brown; the length of the labial palp is two to two and a half times the eye diameter, sides creamy white at base then brown, creamy white and terminally brown, light brown to brown from above, creamy white from below; maxillary palp creamy white, darkly ringed at base of last segment; antenna creamy white to brown. Thorax brown; patagia creamy white with two broad longitudinal dark brown stripes; tegulae dark brown, inner side clearly lined creamy white. Forewing, groundcolour creamy white very densely suffused with ochreous to dark brown scales; medial fascia single, yellow, nearly straight to slightly convex, inner side whitish bordered, sometimes with small yellowish spot, fascia running to ca. one-third of the dorsum; subterminal line dark brown, about midway between terminal black dots and termination of posterior area; area adjacent to terminal black dots white; seven black terminal dots, formula 2-3-2;

fringes shiny, evenly grey. Hindwing dark brown, subterminal fascia absent; fringes light brown with dark brown line.

Abdomen. — Sternite III with elongated groove, without pits. The slide is too badly made to describe scale formation if present.

Male genitalia (fig. 18). — Uncus stout, tapering to sharp pointed tip; gnathos equal in length, dorsal basal part bluntly enlarged; sacculus inconspicuous; processus basalis small, inconspicuous; costa stronger sclerotized ending in pointed tip; cucullus normal; juxta broad triangular; vinculum short, rectangular; aedeagus with circa four large cornuti.

Female genitalia (fig. 23). — Papillae anales indented; tergite VIII semi-connected forming inconspicuous projection-like sclerotization; ostium simple; ductus bursae short, sclerotized, terminal part broadened, sac-like; ductus seminalis not found in slide; bursa copulatrix oblong, without signum.

Biology. — Unknown. Specimens have been caught in July and August. Found at an altitude of 1650 m.

Distribution (fig. 10). — East and central China.

Remarks. — Bleszynski (1965) quotes the holotype label as 'Kwansien F.7.31', but upon checking, it reads 'F.7.30'.

*Metaeuchromius euzonellus* (Hampson, 1896) comb. n. (figs. 1, 2, 3, 9, 13, 21, 27)

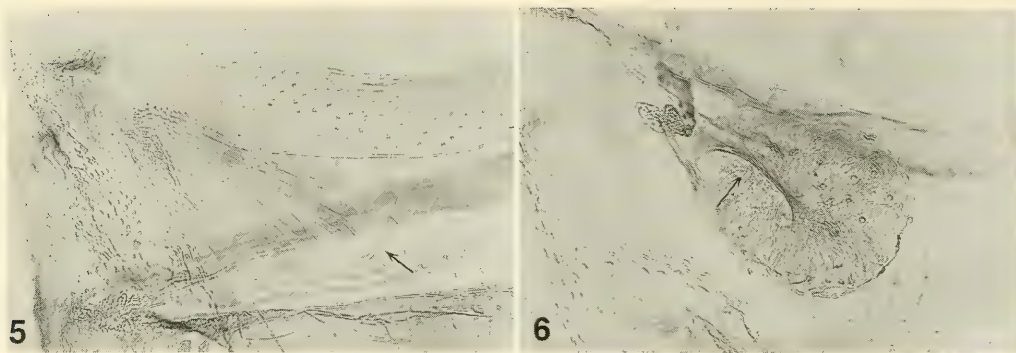
*Diptychophora euzonella* Hampson, 1896: 18. Lectotype: ♂, 'Khasi June, 1894 Nat. Coll', GS 7481 (BMNH).

Material. — 20♂ 3♀. India: Assam: Cherrapunji, 4♂ 2♀ (BMNH); Khasi Hills, 7♂ (BMNH); Khasi, 9♂ 1♀ (BMNH).

Diagnosis. — Resembles species with forewing groundcolour white, differs in having five or four black terminal dots. Differs in male genitalia in having a fish-hook shaped gnathos, strongly bent downward with upward curved tip. Differs in female genitalia from all other species in having tergite VIII armed with sharp pointed tips.

External characters (fig. 13). — Wingspan 12–13 mm. Frons slightly produced forward, white; vertex white; the length of the labial palp is three times the eye diameter, with sides white at base, becoming brown-grey, white from above and below; maxillary palp white, brown at base; on antenna white, brownish on upper half. Thorax, patagia and tegulae brownish white. Forewing groundcolour white, densely suffused with dark-brown scales, anterior part with yellow-brown patch at costa, sometimes a second brown patch near the medial fascia; medial fascia single, slightly convex, running to halfway of the dor-





Figs. 5-6. — 5, *M. latus*. Specialized scales covering the shallow, elongated scent organ. Arrow points to the terminal edge of the glandular groove. 6, *M. changensis*. Abdominal scent organ with small opening (arrow) and "pits" in the wall of the abdominal scent organ.

sum; subterminal line diffuse, brown, about midway between terminal dots and termination of posterior area; area adjacent to terminal dots white; five or four black terminal dots, formula 3-2 or 3-1; fringes shiny, evenly lead-grey, two white patches. Hindwing creamy white to light brown, subterminal fascia present, termen darkly bordered; fringes white with brownish line.

Abdomen (figs. 1-3). — Scent organs incorporated in the abdomen, round, large opening laterally directed. Wall of scent organs with large pits. Scent organs covered with relatively broad scales. Tips of scales touch scent organ pit. Scales can be put at a right angle from the abdomen, thus spreading the scent organs' contents (fig. 3).

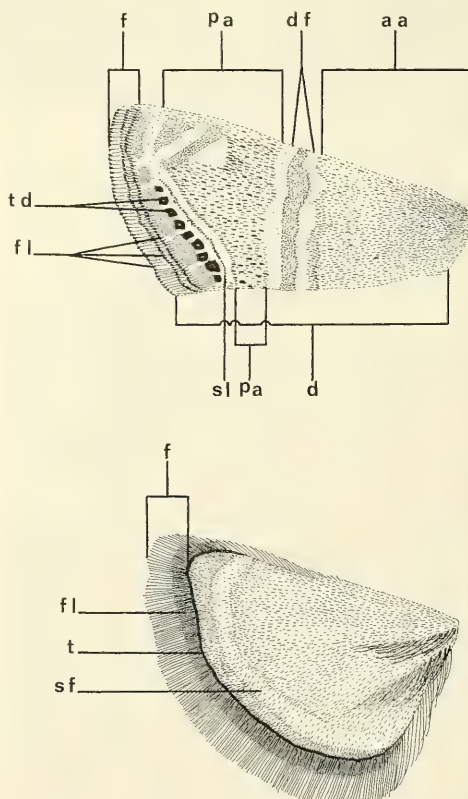
Male genitalia (fig. 21). — Uncus strongly bent, tip curved upward; gnathos proceeding beyond uncus, dorsal thorns elongated; sacculus inconspicuous; costa armed with very stout double pointed projection, smaller one with curved tip, cucullus slender, tip pointed; juxta narrow; aedeagus slender, armed with tooth-like cornutus.

Female genitalia (fig. 27). — Papillae anales small, indented; membrane of tergite VIII without sclerotization, tergite VIII with sharp pointed tips; ostium simple with broadly rounded projection; ductus bursae long; ductus seminalis narrow; bursa copulatrix roundish, with spined area, without signum.

Biology. — Unknown. Caught in April, May, June, July and September.

Distribution (fig. 9). — India: Assam.

Fig. 7. Wing pattern. aa = anterior area; d = dorsum; df = double fascia; f = fringe; fl = fringe line; Pa = posterior area; sf = subterminal fascia; sl = subterminal line; t = termen; td = terminal dots.



*Metaeuchromius flavofascialis* Park, 1990  
(fig. 10, 20)

*Metaeuchromius flavofascialis* Park, 1990: 139. Holotype: ♂, Chuncheon, GW, 30.VII.1988 (K.T. Park), GS 1840. Kangweon National University, Chuncheon.

Material. – 6♂. China: West Tien-mu-shan [=Tianmu Shan], 1♂ (BMNH). Korea: Chuncheon, 2♂ (KNUC), 1♂ (RTAS); Sogumgang, 1♂ (KNUC); Mt. Samag, 1♂ (KNUC).

Diagnosis. – Externally very similar to the other species of the genus. Differs in male genitalia (female unknown) in having the cucullus ending in a slender tip, in combination with the group of cornuti occupying less than one-third of the length of the aedeagus.

External characters. – Wingspan 13 mm. Frons not produced forward, creamy white; vertex creamy white; the length of the labial palp is one and a half times the eye diameter, with the sides creamy white at base becoming brown, creamy white to brown from above and below; maxillary palp creamy white, darkly ringed at base of last segment; on antenna creamy white with some inconspicuous darker scales. Thorax creamy white to light brown; patagia creamy white with two broad longitudinal brown stripes; tegulae brown, inner side lined creamy white. Forewing groundcolour creamy, white densely suffused with ochreous to dark brown scales, posterior area with one or two small inconspicuous dark brown spots; medial fascia nearly straight, running to circa one-third of the dorsum; subterminal line brown, about midway between terminal dots and termination of posterior area; area adjacent to terminal black dots white; seven black terminal dots, formula 2-3-2; fringes shiny, evenly grey. Hindwing creamy white to light grey, subterminal fascia very inconspicuous, termen darkly bordered; fringes creamy white with darker line.

Abdomen. – No indication of scent organs or special formation of scales on sternite III.

Male genitalia (fig. 20). – Uncus tapering to sharp pointed tip; gnathos about equal in length to uncus, dorsal thorns absent; sacculus inconspicuous, processus basalis slender, fold reaching to the middle of the tip of the valvae, cucullus ending in sharp pointed tip; juxta elongated, more or less rectangular; aedeagus relatively large, vesica with one group of cornuti.

Female genitalia. – Female unknown.

Biology. – Unknown. Caught in July, August and September. The locality of Mt. Samag was at 650 m altitude.

Distribution (fig. 10). – Eastern part of China and Korea.



Fig. 8. Distribution map. *M. latus* (dots) and *M. latoides* (triangles).

Fig. 9. Distribution map. *M. yuennanensis* (squares), *M. changensis* (dots), *M. inflatus* (triangles) and *M. euzonellus* (diamond).

Fig. 10. Distribution map. *M. circe* (triangles), *M. flavofascialis* (diamond).



Figs. 11-14. — 11, *Metaeuchromius yuennanensis*. 12, *Metaeuchromius changensis*. 13, *Metaeuchromius euzonellus*. 14, *Metaeuchromius circe*.

Fig. 15. *Metaeuchromius latus*



*Metaeuchromius inflatus* sp. n.  
(figs. 9, 22, 28)

Type-material. – Holotype ♂, 'Nepal Prov. Chisapani Garhi Bhainse Dobhan 730m 16.-20.VII.1967 leg. Dierl-Schaft Staatsslg. München', GS RS 483. Paratype ♀, same data as holotype, GS RS 501, both in ZSMC.

Diagnosis. – Resembles species with groundcolour of forewing white. Differs in male genitalia in having the processus basalis strongly swollen, rounded. Can be distinguished in female genitalia in having the ostium lip-shaped in combination with broad, strongly sclerotized ductus bursae continued into a sac-like part.

External characters. – Wingspan 11-13 mm. Frons not produced forward, white to creamy white; vertex creamy white, the length of the labial palp is one and a half to two times the eye diameter, with the sides white to creamy white, tip brown-grey, light brown from above, white to creamy white from below; maxillary palp white, dark brown ringed at base of last segment; antenna white-brown ringed. Thorax, patagia and tegulae white with yellow scales. Forewing groundcolour pure white, densely suffused with brown scales; medial fascia single more or less straight, running to halfway to one-third of the dorsum; subterminal line brown, closer to termination of posterior area than to terminal black dots; area adjacent to terminal black dots broad, white; seven black terminal dots, formula 2-3-2; fringes shiny, white with brown lines in upper half, brown at base and white terminally in lower half. Hindwing white, subterminal fascia absent, termen with inconspicuous dark spot at inner corner; fringes white.

Abdomen. – No indication of scent organs or special formation of scales on sternite III.

Male genitalia (fig. 22). – Uncus long, slender, tapering to sharp pointed tip; gnathos equal in length to the uncus, without dorsal thorns; processus basalis large, roundish, swollen, cucullus ending in inwardly bent tip; juxta somewhat rectangular; vinculum long, pointed; aedeagus relatively large, with two large cornuti.

Female genitalia (fig. 28). – Papillae anales more or less fused; ostium relatively large, with small lip; ductus bursae broad, strongly sclerotized in upper part, followed by enlarged sac-like part, ending slightly swollen above bursa copulatrix; ductus seminalis narrow; bursa copulatrix oblong, without signa.

Biology. – Unknown. The specimens were caught in July at 730m altitude.

Distribution (fig. 9). – Only known from Nepal.

*Metaeuchromius latoides* sp. n.  
(fig. 8, 26)

Type-material. – Holotype: ♀ 'Turquie Acigol U.V., 31-7-1973 U. Dall'Asta' GS R.S.470 (in MAES).

Diagnosis. – Differs from most species in having a whitish medial fascia. Differs from *M. latus* in having eight black terminal dots (this character may turn out to be invalid when more material is collected). Differs in female genitalia from *M. latus* in lacking the small roundish signum in the oblong bursa copulatrix.

External characters. – Wingspan 19 mm. Frons not produced forward, creamy white mottled with brown; vertex creamy white mottled with brown; the length of the labial palp is two and a half times the eye diameter, creamy white mottled with brown; maxillary palp lost on holotype; on antenna creamy white to brown. Thorax and patagia creamy white mottled with dark brown; tegulae creamy white, coarsely brown mottled. Forewing groundcolour creamy white, densely suffused with ochreous to dark brown scales, posterior area with two, more or less clear, dark brown spots; medial fascia single, convex, white, running to about halfway of the dorsum, subterminal line brown, about midway between terminal dots and termination of posterior area; area adjacent to terminal dots yellow to white; eight or nine black terminal dots, formula 2-2-3-1 or 2-2-3-2; fringes too worn to be described. Hindwing brownish, light subterminal fascia present, termen darkly bordered; fringes brownish.

Male genitalia. – Unknown.

Female genitalia (fig. 26). – Papillae anales small; membrane and tergite VIII very long, tergite very lightly sclerotized, apophyses very long; ostium very simple, roundish; ductus bursae normal swollen under ostium, finely wrinkled; ductus seminalis narrow; bursa copulatrix weakly sclerotized, oblong, without signa.

Biology. – Unknown. the holotype was caught at the end of July.

Distribution (fig. 8). – Turkey.

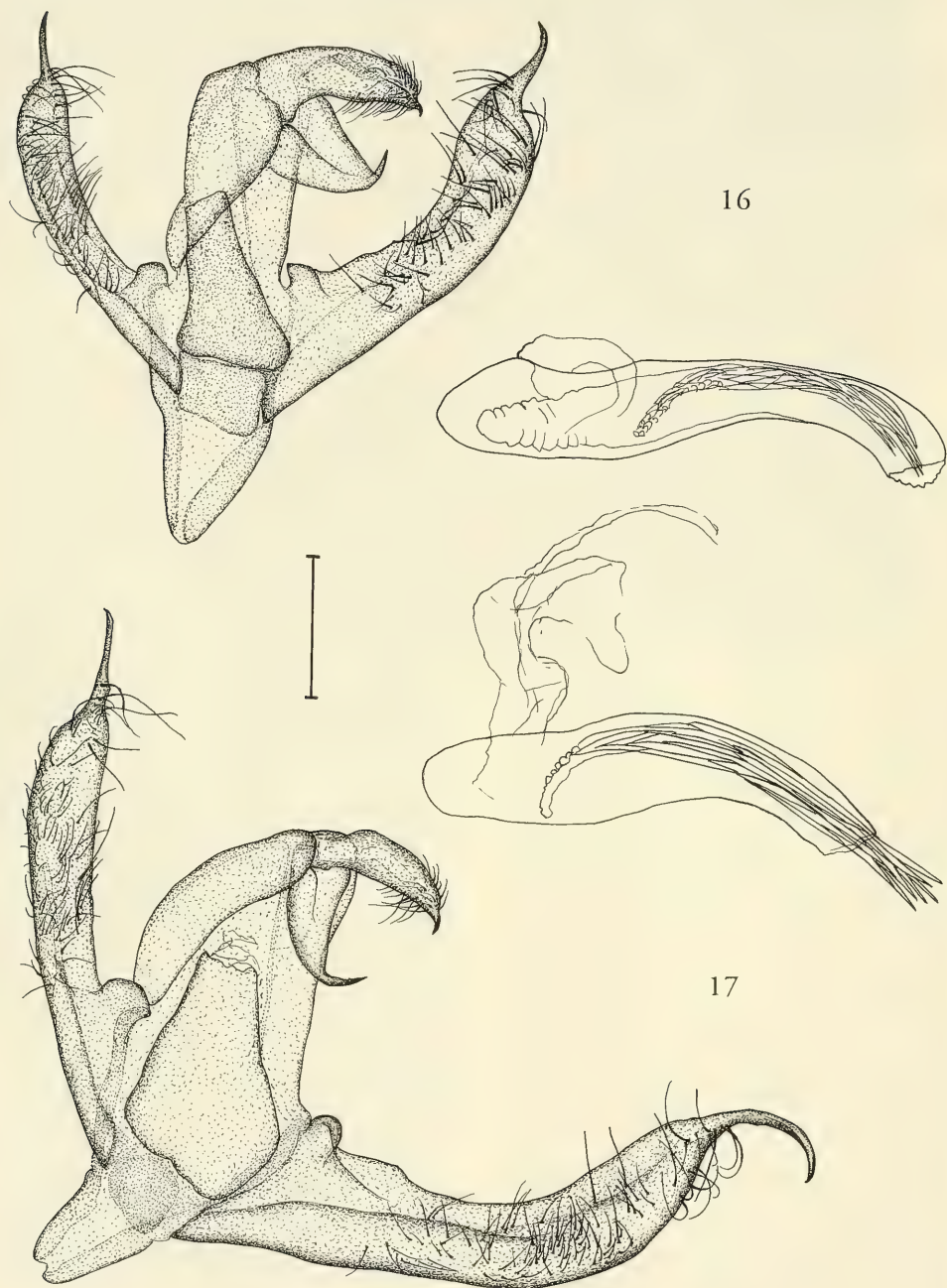
*Metaeuchromius latus* (Staudinger, 1870) comb. n.  
(figs. 5, 8, 15, 19, 25)

*Eromene lata* Staudinger, 1870: 204. – Holotype ♀, 'Graecia Kr.', GS 1147 (in ZMHB).

*Pseudeuchromius latus* (Staudinger, 1870) – Bleszynski, 1965: 90.

*Pseudochromius latus* (Staudinger). – Maes 1986: 79 [lapsus calami].

Material. – 5♂, 13♀. Greece: Graecia Kr. 1♀



Figs. 16-17. Male genitalia; ventro-caudal aspect, valvae spread; aedeagus separated, lateral aspect. — 16, *Metaeuchromius changensis*; 17, *Metaeuchromius yuennanensis*. Scale bar 0.5 mm.

(ZMHB); 2 km SW of Anoyia, 1♂ (RTAS); Mt. Taygetos, 1♂ (RTAS), 3♂, 2♀ (ZMUC); Zachlorou, 1♂, 2♀ (BMNH), 1♀ (RTAS), 7♀ (ZMUC).

**Diagnosis.** – Differs from most species in having a whitish medial fascia. Differs from *M. latoides* in having six or seven black terminal dots (this character may turn out to be invalid when more material becomes available). Differs in female genitalia from *M. latoides* (male unknown) in having a small signum in the roundish bursa copulatrix.

**External characters** (fig. 15). – Wingspan 18–22 mm. Frons not produced forward, creamy white to light brown; vertex creamy white; the length of the labial palp is three times the eye diameter, with the sides light brown to creamy white at base, becoming lead-grey, brown from above, creamy white from below; maxillary palp brown; on antenna creamy white, darkly ringed. Thorax light brown to brown; patagia brown; tegulae brown evenly mottled. Forewing groundcolour creamy white, densely suffused with ochreous to dark brown scales, posterior area with two more or less clear dark brown spots; medial fascia single, convex, white, running to halfway to one-third of the dorsum; subterminal line dark-brown, about midway between terminal dots and termination of posterior area; area adjacent to terminal dots yellow to white; six or seven black terminal dots, formula 2-3-1 or 2-3-2; fringes evenly lead-grey. Hindwing light grey, subterminal fascia present, termen darkly bordered; fringes grey to creamy white.

**Abdomen** (fig. 5). – Scent organs only indicated by minute fold of sternite III, pits absent. Sternite III armed with elongated broad scales.

**Male genitalia** (fig. 19). – Uncus stout, tapering to sharp double pointed tip; gnathos equal in length or slightly shorter than uncus, dorsal thorns absent; sacculus inconspicuous, sclerotized, processus basalis inconspicuous, costa stronger sclerotized to halfway, stronger sclerotized part ending pointed, cucullus broad, rounded; juxta elongated; vinculum long, pointed; aedeagus very large, posterior part swollen, with one elongated group of short cornuti.

**Female genitalia** (fig. 25). – Papillae anales small; membrane and tergite VIII very long, tergite very lightly sclerotized, apophyses very long; ostium very simple, round; ductus bursae widening proximal to the ostium, then wrinkled, distal half with contorted slightly sclerotized lining; ductus seminalis narrow; bursa copulatrix roundish, with one very small roundish signa.

**Biology.** – Habitat at 600 m altitude: shrubby and hilly area grazed occasionally by sheep. Specimens were caught in the last week of June, July and August at an altitude of 600 to 1000 m.

**Distribution** (fig. 8). – So far only found in Greece; records from Turkey (e.g. Maes 1986) may refer to *M. latoides*.

**Remarks.** – Bleszynski (1965) does not mention a signum in his description nor is one present in the drawing of the female genitalia. Upon checking the holotype, it turned out to have a small signum. Perhaps due to not removing the genitalia from the abdomen and not colouring the slide Bleszynski missed seeing the small signum.

*Metaeuchromius yuennanensis* (Caradja, 1937)  
(figs. 9, 11, 17, 24)

*Eromene yuennanensis* Caradja, 1937: 151. Lectotype: ♂, 'Likiang, (China). Provinz Nord-Yuennan, 4.8.1934. (not 10.6.1935 as stated in Bleszynski 1965) H. Höne'. Muzeul de Istoria Naturala 'Grigore Antipa', Bucuresti.

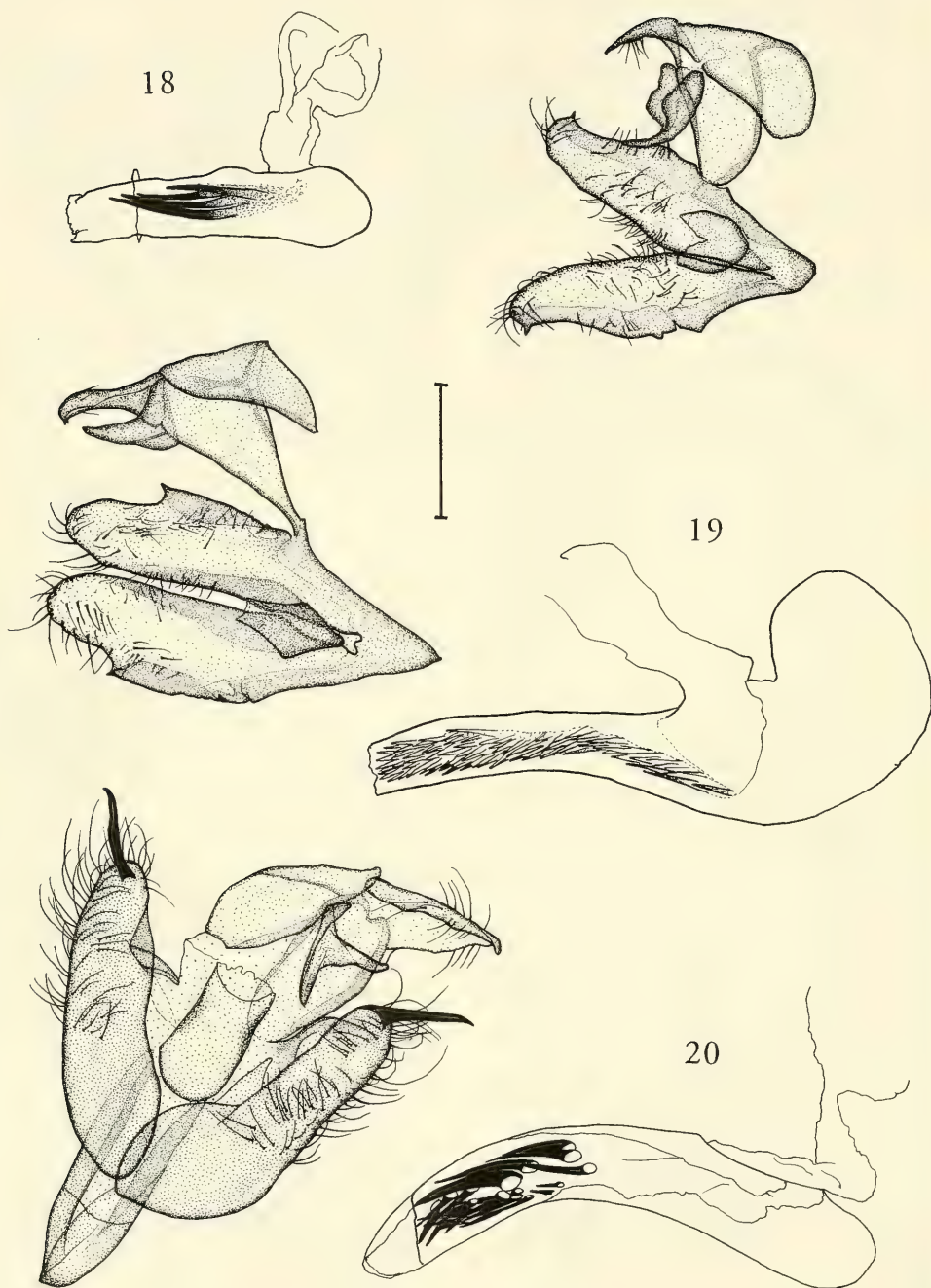
*Metaeuchromius yuennanensis* (Caradja, 1937) Bleszynski, 1960: 217. – Bleszynski 1963: 112.

**Material.** – 9♂, 7♀. China: Likiang, 2♂, 1♀ (BMNH), 1♂, 1♀ (RTAS), 3♂, 3♀ (ZFMK), 2♂, 2♀ (BUCU); West Tianmu Shan, 1♂ (ZFMK).

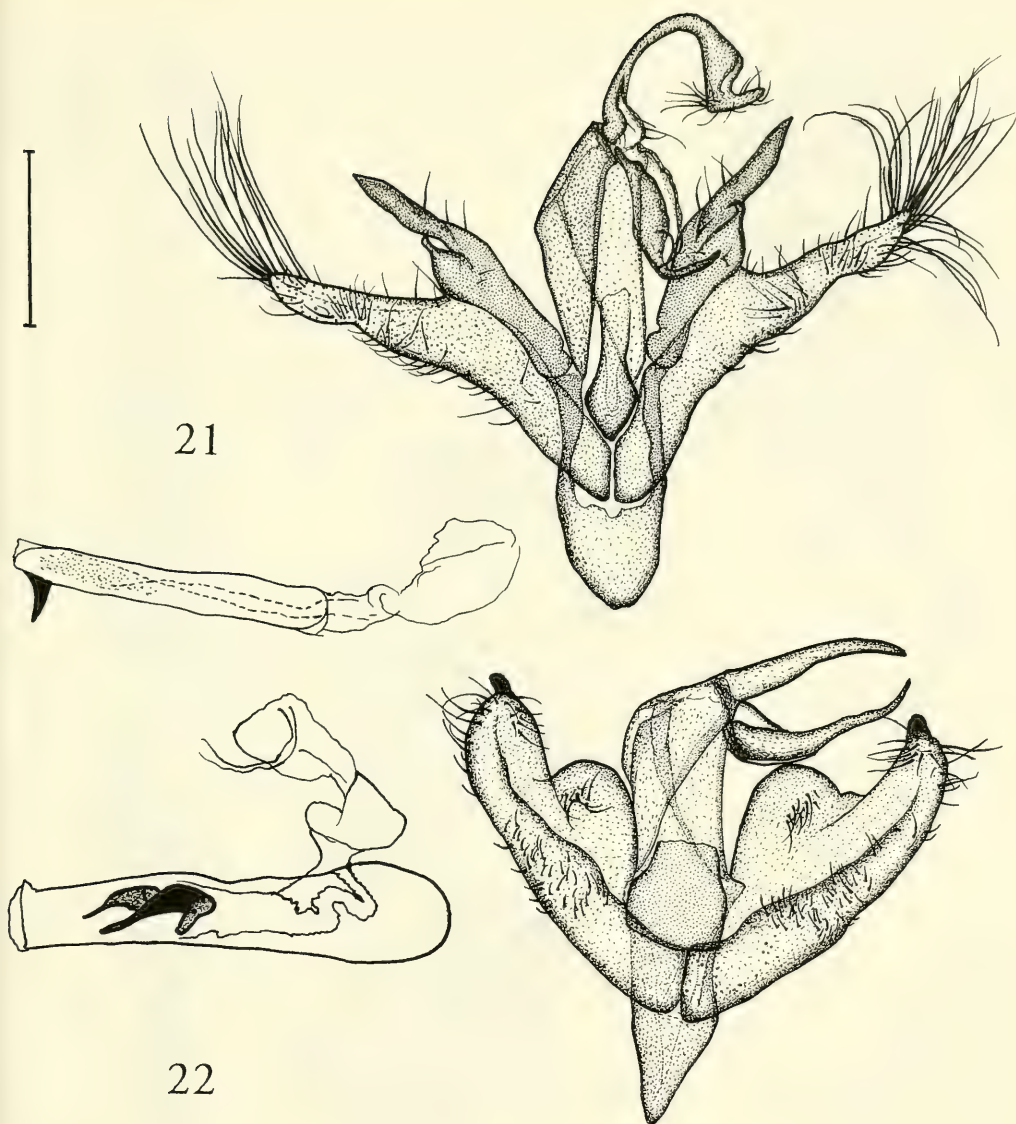
**Diagnosis.** – Differs in male genitalia from all species in having the valvae asymmetrical and the cucullus ending in a bent, slender tip, in combination with the total length of the group of cornuti about equal to that of the aedeagus. Differs in female genitalia (female of *M. changensis* is unknown) in having the ductus bursae split in two parts, of which one is strongly sclerotized and partly armed with spines, ending less sclerotized and somewhat wrinkled.

**External characters** (fig. 11). – Wingspan 16–20 mm. Frons not produced forward, creamy yellow-white; vertex creamy yellow-white; the length of the labial palp is twice that of the eye diameter, with the sides creamy white at base becoming brown, light brown from above, creamy white from below; maxillary palp light brown, darkly ringed at base of last segment, terminal part light brown; on antenna creamy white, inconspicuously ringed. Thorax brown; patagia yellow-brown; tegulae brown, inner side clearly lined creamy white. Forewing groundcolour creamy white, densely suffused with grey and ochreous to dark brown scales, posterior area with more or less clear dark spot near medial fascia; medial fascia single, slightly convex, running to one-fourth to one-third of the dorsum; subterminal line brown, about midway between terminal dots and termination of posterior area; area adjacent to terminal black dots white; seven black terminal dots, formula 2-3-2; fringes shiny, evenly grey. Hindwing creamy white to grey, subterminal fascia clearly present, termen darkly bordered; fringes creamy white with faint darker line.





Figs. 18-20. Male genitalia; ventro-caudal aspect, valvae spread; aedeagus separated, lateral aspect. – 18, *Metaeuchromius circe*; 19, *Metaeuchromius latus*; 20, *Metaeuchromius flavofascialis*. Scale bar 0.5 mm.

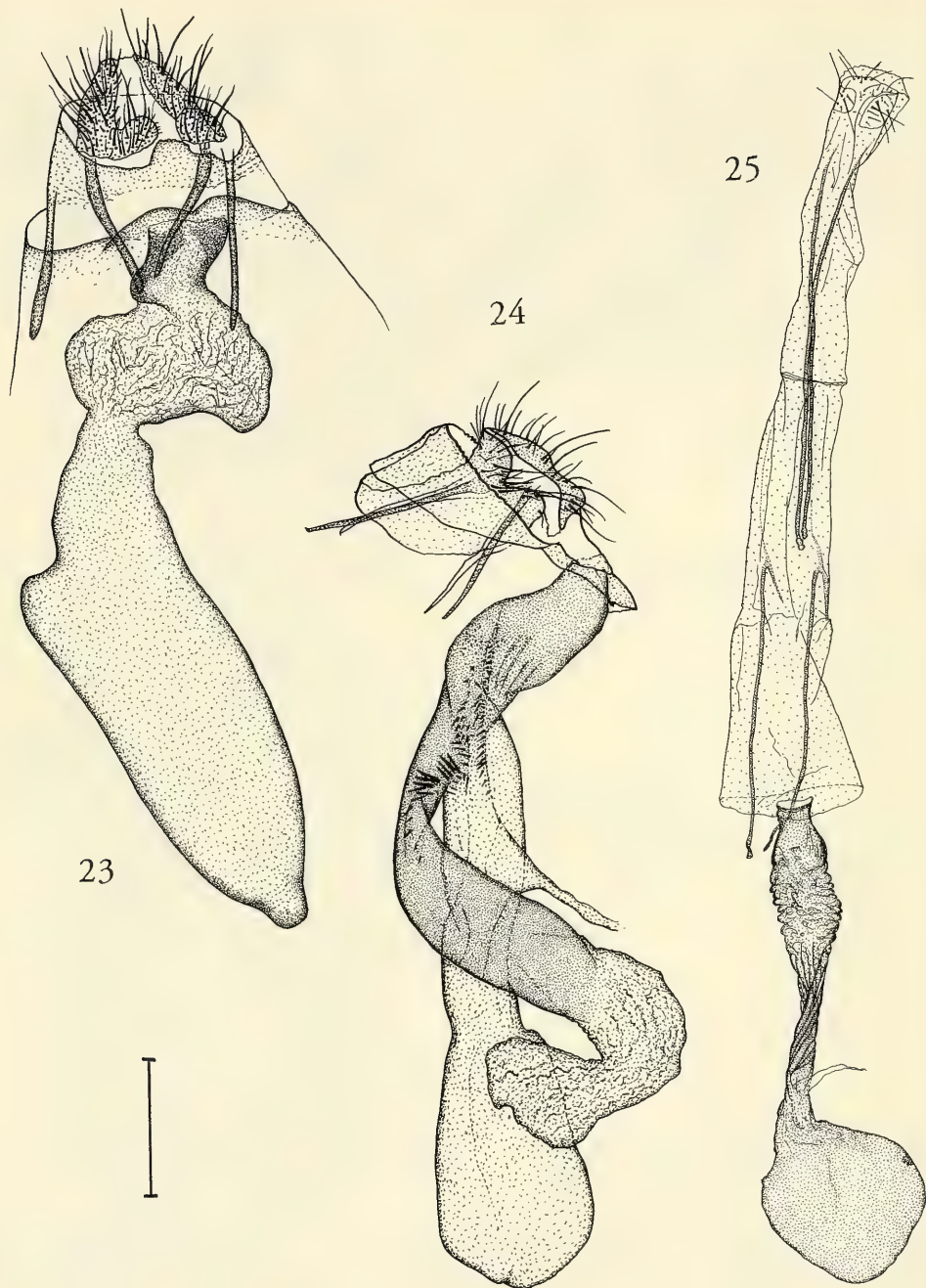


Figs. 21-22. Male genitalia; ventro-caudal aspect, valvae spread; aedeagus separated, 21 ventral aspect, 22 lateral aspect. — 21, *Metaeuchromius euzonellus*; 22, *Metaeuchromius inflatus*. Scale bar 0.5 mm.

Abdomen. — Two scent organs incorporated in the abdomen, roundish, kidney-shaped, with small opening laterally directed. Wall of scent organs with pits. No special scale formation observed in relation to the scent organs.

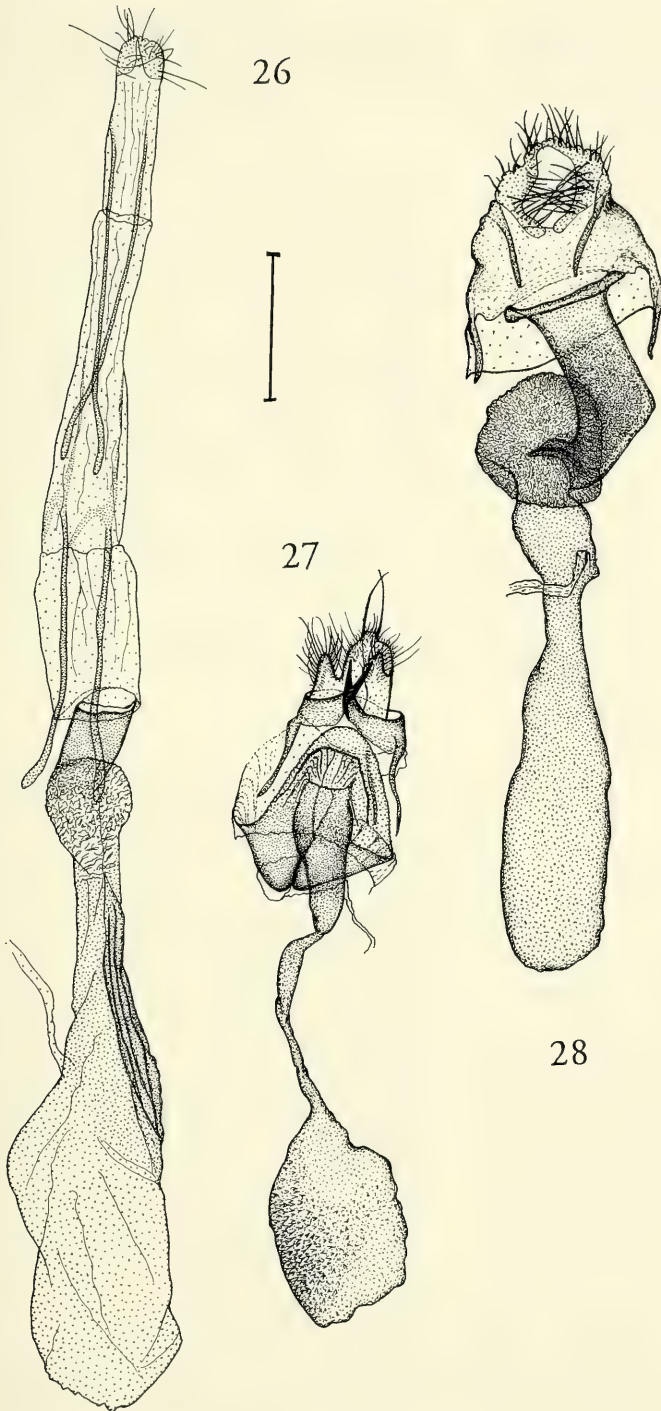
Male genitalia (fig. 17). — Uncus tapering to sharp pointed tip; gnathos equal in length to uncus, dorsal thorns absent; valvae asymmetrical, sacculus slender

in one valve, normal in the other, processus basalis somewhat rectangular, cucullus asymmetrical, ending in bent pointed tip unequal in size; juxta large somewhat oblong; vinculum normal; aedeagus shorter than length of smaller valve, with many very long cornuti, total length of cornuti as long as length of aedeagus.



Figs. 23-25. Female genitalia; ventral aspect. – 23, *Metaeuchromius circe*, scale bar 0.5 mm; 24, *Metaeuchromius yuennanensis*, scale bar 0.5 mm; 25, *Metaeuchromius latus*. Scale bar 0.85 mm.





Figs. 26-28. Female genitalia; ventral aspect. — 26, *Metaeuchromius latoides*, scale bar 0.85 mm; 27, *Metaeuchromius euzonellus*, scale bar 0.5 mm; 28, *Metaeuchromius inflatus*, scale bar 0.5 mm.

Female genitalia (fig. 24). — Papillae anales idened; ostium simple; ductus bursae split in two parts, one very long strongly sclerotized part with many spines which ends sac-like, wrinkled and less sclerotized, second part; ductus seminalis narrow; bursa copulatrix oblong, without signum.

Biology. — Unknown. The specimens have been caught in August and September at an altitude of up to 3000 m.

Distribution (fig. 9). — China. See also under remarks.

Remarks. — There may be another species very similar to *M. yuennanensis* occurring in Japan, or *M. yuennanensis* itself inhabits Japan. A specimen was found identified as *M. yuennanensis* in the BMNH. The lack of abdomen makes it impossible to decide whether it belongs to a new species or not.

### *Metaeuchromius yuennanensis tibetanus* Bleszynski

*Metaeuchromius yuennanensis tibetanus* Bleszynski, 1965: 87. Holotype: ♂, Batang, (Tibet). Im Tal des Yangtze (ca. 2800 m) 13.9.1936. H. Höne'. Paratypes 1♂, 2♀ 22.9.1936, 18.9.1936, 1.9.1936. All in BUCU.

Diagnosis. — The slightly lighter colouration of the fore wings is the only distinguishing character of this subspecies.

Biology. — Unknown. The specimens have been caught in September at an altitude of 2800 m.

### DISCUSSION

The males of *Metaeuchromius yuennanensis*, *M. changensis*, *M. latus*, *M. circe* and *M. euzonellus* have ventrally located abdominal scent organs which provide these species with a synapomorphic character.

*M. latoides* is only known from the unique female. Comparing this species with the other females of *Metaeuchromius* it can be seen to be most closely related to *M. latus*. This conclusion is based on the almost similar features of the genitalia. The only difference is the presence of a signum in *M. latus* and the presence of two extra black terminal dots in *M. latoides*. This very close relationship allows the conclusion that the up to now unknown male of *latoides* must also have abdominal scent organs.

The males of *M. flavofascialis* and *M. inflatus* lack these male scent organs. However, the placement by Dr. Park of *flavofascialis* in the genus *Metaeuchromius* is in my opinion justifiable considering the other characters it shares with the other members of the genus. *M. inflatus* also lacks the abdominal scent organs, but in light of other characters (wing pattern, gnathos and valvae) it most logically belongs in

*Metaeuchromius*. *M. euzonellus* has the Sc and R<sub>1</sub> of the forewing partly fused, but the presence of the abdominal scent organs are regarded as being more important. Also, within several other Crambinae genera, and even within a single species, the fusion of Sc and R<sub>1</sub> are known to be variable.

### ACKNOWLEDGEMENTS

I wish to thank the following persons and institutes for loans of material without which this study would not have been possible. Dr. W. Dierl (ZSMC, München, Germany), Dr. O. Karsholt (ZMUC, Copenhagen, Denmark), Dr. K. Maes (MRAC, Tervuren, Belgium), Dr. M. Mey (ZMHB, Berlin, Germany), Prof. Dr. K. T. Park (KNUC, Kangwon, Korea), Dr. D. Stuning (ZFMK, Bonn, Germany).

Dr. B. Landry is acknowledged for his comments on the manuscript.

As always I am greatly indebted to Mr. M. Shaffer (BMNH, London, United Kingdom) for his encouragements, help and great expertise on which I can always rely and ask for.

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## BOOK REVIEW

Bengt Å. Bengtsson, 1997. Scythrididae. – Microlepidoptera of Europe (P. Huemer, O. Karsholt & L. Lyneborg eds.) vol. 2, 301 pp., 14 colour plates, 419 figs. Hardback, 24 × 17 cm. Apollo Books, Stenstrup. [ISBN 87-88757-11-0]. Price DKK 500.– excl. postage.

The second volume of this new series (see this journal, vol. 139: 84 for a review of the first volume), treats 237 species of this relatively unknown family of micro-moths. These moths, often day-flying, are most abundant in the mediterranean region. This is the first time that this family is revised for this large geographic area, resulting in 40 (!) new species (three of which are described by Passerin d'Entreves) and in many other nomenclatural changes. The speciose genus *Scythris* is divided into 64 informal species-groups.

There is a short general introduction and a checklist. All species are briefly described with the following entries: diagnosis, male genitalia, female genitalia, distribution, biology, and often: remarks. Most are illustrated in colour, as water-colours, made by the author, with the right pair of wings depicted only. The male and female genitalia are illustrated in simple line-drawings.

The author is to be congratulated for bringing together this overwhelming amount of information in a relatively short time. The descriptions are adequate, and the water-colours look nice. It is unfortunate that they are not printed bigger. They are 4-5 × natural size (measured from size in the description: I have not been able to find an indication of the magnification), but particularly some of the smaller ones show very little detail. The white species are almost invisible against the white paper background, why haven't they been brought together, and printed on a darker background? The black-and-white drawings are relatively bold, and do not compare with the quality of the colour-plates.

This series is announced as an identification series.

In this light it is to be regretted that the book does not provide any help to the inexperienced user, to get familiar with the overwhelming number of similarly looking moths. The author believes that leafing through colour plates and genitalia-illustrations is the quickest way to arrive at a species identification (page 11). However, one needs to have an enormous memory for forms, when comparing 237 species. With all the problems which keys can provide, I would have much preferred to have some sort of key, to bring structure in this large amount of variation. That should not necessarily be a dichotomous key, but could have been a table of distribution of some important character-states. Also the species-groups do not really help, because there is no indication how to identify a species into a group. With modern computer technology, the design of a key would have been quite well possible, even with this amount of information. Another omission is, in my opinion, an index to hostplants. Even with the little knowledge about this topic for the scythrids, it would have facilitated the search for certain hosts.

My final comments are on the design of this book. Although this may be partly affected by personal taste, the design of this book is very unbalanced. There has apparently been no professional graphic designer, the used font is too big, there are too many different font types, and there is often too much white on the page. By using a smaller font and two columns, many pages could have been spared, and used to print the colour-illustrations somewhat larger. The distribution catalogue remains (see review vol. 1) also rather unpractical, especially because the countries are listed alphabetically and not geographically.

This work is, in conclusion, an important contribution to the taxonomic knowledge of European and Mediterranean Microlepidoptera, and, despite the somewhat disappointing design, printing, and lack of keys, to be recommended for all serious lepidopterists. [Erik J. van Nieukerken]

# A NEW SPECIES OF *ORNITHOICA* RONDANI FROM NEW CALEDONIA (DIPTERA: HIPPOBOSCIDAE)

Sinclair, B.J. 1997. A new species of *Ornithoica* Rondani from New Caledonia (Diptera: Hippoboscidae). – Tijdschrift voor Entomologie 140: 129-132, figs. 1-6 [ISSN 0040-7496]. Published 31 October 1997.

*Ornithoica caledonica* sp.n. (*pusilla* group) is described from New Caledonia, collected from the endemic flightless bird *Rhinoceros jubatus*. In addition, *Ornithoica plicata* (von Olfers) was collected from the endemic pigeon *Ducula goliath*. A total of six species of Hippoboscidae are now recorded from New Caledonian birds.

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Key words. – Diptera, Hippoboscidae, *Ornithoica*, new species, New Caledonia.

Ectoparasites including louse flies (Diptera: Hippoboscidae) were collected as part of a survey of the parasites and their impact on two birds endemic to New Caledonia; the kagu (*Rhinoceros jubatus* Verreaux & Des Murs) and the notou (*Ducula goliath* (Gray)). Field work was conducted by Dr Frederic Beugnet in association with the CIRAD agency.

The louse fly, *Ornithoica caledonica* sp. n. (assigned to the *O. pusilla* (Schiner) group) was collected from the kagu. The kagu is a pale grey, mid-sized (58 cm), flightless bird (Delacour 1966). Although flightless, the kagu has large, brightly marked, flexible wings, believed to be used for sexual displays (Lindsey 1993). It is a diurnal bird, inhabiting dense rain-forests, and forages on insects, snails, and earthworms (Lindsey 1993). The kagu is an endangered species, with an estimated 200 breeding pairs. The widespread louse fly, *Ornithoica plicata* (von Olfers) was collected from the notou, a large (50 cm) endemic pigeon, which inhabits montane forests (Delacour 1966).

Prior to this study five species of Hippoboscidae were recorded from New Caledonian birds, including the endemic species *Myophthiria neocaledonica* Maa, and the widespread species *Olfersia aenescens* Thomson, *Ornithoica plicata*, *Ornithoica exilis* (Walker), and *Ornithophila metallica* (Schiner) (Maa & Marshall 1981, Maa 1989).

## MATERIALS AND METHODS

Material based on this study will be deposited in the Museum National d'Histoire Naturelle, Paris,

France (MNHP) and Canadian National Collection of Insects, Ottawa, Canada (CNC). Specimens of *O. pusilla* were borrowed from the United States National Museum of Natural History, Washington, USA (USNM).

Terms follow those of McAlpine (1981), except male terminalia where terms of Cumming et al. (1995) are followed. Male and female abdomens were removed, macerated in hot 85% lactic acid, and examined in glycerin.

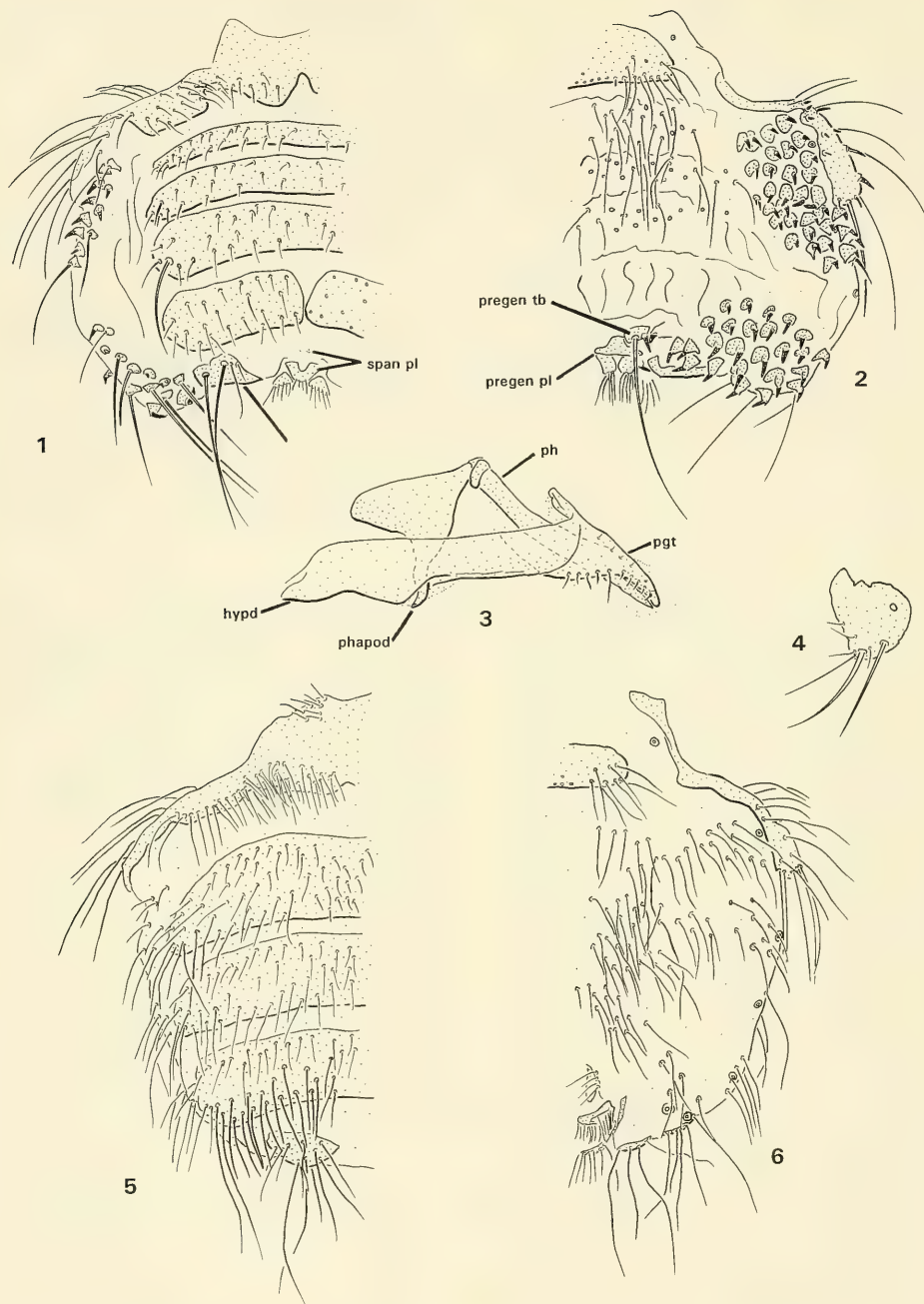
## TAXONOMY

### *Ornithoica pusilla* group

Species of the *O. pusilla* group are distinguished from the remaining species of *Ornithoica* on the basis of female tergite 6 medially divided and by clusters of more than 30 pairs of large anchor-like spines near the apex of the abdomen (Maa 1966).

### Key to species of *O. pusilla* group

1. Apex of female abdomen with dense cluster of anchor-like spines, base of spines in contact with neighbouring spines; female tergite 6 subtriangular; male laterite 6 bearing one long, stout and one short seta . . . . . *O. pusilla* (Schiner)
- Apex of female abdomen with anchor-like spines not densely clustered, base of spines not in contact with neighbouring spines; female tergite 6 rectangular; male laterite 6 bearing five long, stout setae . . . . . *O. caledonica* sp.n.



Figs. 1-6. Female and male abdomens and male terminalia of *Ornithoica caledonica* sp. n. – 1, female, dorsal view; 2, female, ventral view; 3, male terminalia, lateral view; 4, female laterite 7; 5, male, dorsal view; 6, male, ventral view. Abbreviations: hypd, hypandrium; ltg 7, laterite 7; pgt, postgonite; ph, phallus; phapod, phallapodeme; pregen pl, pregenital plate; pregen tb, pregenital tubercle; span pl, supra-anal plate.



*Ornithoica caledonica* sp. n.  
(figs. 1-6)

Type examined. — Holotype ♀: 'NEW CALEDONIA / Parc Rivière Bleue / 1992-94; ex. Kagu / coll. F. Beugnet, / Y. Létocart & R. Gader'; 'HOLOTYPE / *Ornithoica* / *caledonica* / Sinclair' (MNHP).

Paratypes: Same data as holotype (1 ♂, 3 ♀, CNC; 2 ♂, 3 ♀, MNHP).

Recognition. — Females distinguished from *O. pusilla* by a rectangular tergite 6, narrowly divided and lacking long stout setae, crescent-shaped supra-anal plate, pregenital tubercle bearing one long seta and one long spine-like seta, subtriangular laterite 7, and apex of abdomen with anchor-like spines less densely clustered. Males are distinguished by 5 long, strong setae on laterite 6 and by the slender ventral arm of the phallapodeme.

Etymology. — Named in reference to the type locality.

## Description

Female. — Wing length 3.25-3.5 mm

Thorax. Presutural scutum (prescutum) with long, pale setae, about as dense as scutellum; postsutural scutum (scutum) largely bare, with transverse row of pale setae along posterior margin. Scutellum with 2 long and 3 shorter pairs of dark, subapical setae. Anterior margin of prosternum truncate.

Wing. Microtrichia covering only extreme tip of cell  $r_{2+3}$ ; cells  $r_{4+5}$  and  $m_{1+2}$  mostly covered by microtrichia except for basal fifth; cell  $cuA_1$  with patches along vein.

Abdomen. Richly spinose; syntergite 1+2 with short, fine setae; dorsal setae on tergites 3-6 shorter than length of tergites; lateral setae on tergites 3-5 more pronounced; lateral setae on tergite 5 twice length of tergite; tergite 5 longer than 3 or 4; tergite 6 narrowly divided medially into pair of broad rectangular sclerites, lacking long stout setae. Laterite 2 with marginal setae longer than tergites 3 and 4 combined; ventrolateral margin of laterite 2 with short, spine-like setae; laterite 7 subtriangular, with 3 strong setae and 4 setulae. Dorsolateral membranous region above level of spiracles lacking setae. Sternite 1 with numerous marginal setae and 1 median spine-like seta; disc of venter with 7-8 rows of slender setae, basal ring pale; setae lacking anterior to pregenital tubercle; pregenital tubercle paired, bearing 1 long strong seta and 1 long spine-like seta. Anchor-like spines clustered in 2 widely separate groups; spines equal in size; base of spines not in contact with neighbouring spines. Supra-anal plate with anterior and posterior sclerites

clearly separated, both crescent-shaped; anterior sclerite thinly sclerotized; posterior sclerite with 2 pairs of setulae, outer pair longer than median; pregenital plate somewhat '⊥'-shaped.

Male. — Similar to female. Tergites 3-5 broader than female; tergite 6 widely divided into pair of subrectangular sclerites; laterite 6 slender, bearing 5 long, strong setae; spiracle 7 lying anterior to 6; ventrolateral setae mounted on slightly raised sockets. Terminalia: Phallapodeme (basal apodeme) subtriangular, ventral edge constricted forming long slender process; postgonite or gonostylus (tip of penis valve) strongly arched and tapering, margin with row of setulae; phallus (aedeagus) slender, tapering to point, encased in membranous sheath.

Remarks. — Prior to this study, the *O. pusilla* group was monotypic. *Ornithoica pusilla* is widespread among the atolls and small islands of the central Pacific, and found on a variety of hosts (Maa 1966, Maa 1989).

*Ornithoica caledonica* was collected on the kagu, an endemic bird of uncertain relationships, assigned to the Rhynchoetidae of the order Gruiformes (rails, cranes, buttonquail and allies) (Lindsey 1993). The kagu is restricted to La Grand Terre or the main island of New Caledonia.

## *Ornithoictona plicata* (von Olfers)

Material examined. — NEW CALEDONIA: Parc Rivière Bleue, ix.1993-xii.1994, ex. Notou, F. Beugnet, Y. Létocart & R. Gadet (2 ♂, CNC).

Remarks. — Specimens of *Ornithoictona plicata* were collected on the notou, an endemic pigeon (*Ducula goliath*). This hippoboscid is widespread on islands in the Pacific and Indian Oceans and has been recorded from about 50 genera of land and aquatic birds (Maa & Marshall 1981). In New Caledonia, *O. plicata* was previously recorded from Grande Terre and the Loyalty Is. (Maa 1989). In New Guinea, *O. plicata* has been collected on *Ducula zoeae* and in Vanuatu (New Hebrides) it has been collected on *D. pacifica* (Maa 1969, Maa & Marshall 1981).

## ACKNOWLEDGEMENTS

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## THE GENUS *PROCORDULIA* MARTIN IN WESTERN MALESIA (ODONATA, CORDULIIDAE)

Descriptions and records of Malesian Odonata, 4 \*)

Tol, J. van, 1997. The genus *Procordulia* Martin in western Malesia (Odonata, Corduliidae). Descriptions and records of Malesian Odonata, 4. – Tijdschrift voor Entomologie 140: 133–146, figs. 1–27. [ISSN 0040-7496]. Published 31 October 1997.

The species of the genus *Procordulia* occurring in Malaysia, the Philippines and Indonesia, excl. New Guinea, are discussed and a key to the species is provided. *P. papandayanensis* is described from Java, and *P. lompobatang* and *P. rantemario* from SW Sulawesi. These new species all belong to the *P. sambawana* group of species.

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Key words. – *Procordulia*; Malesia; Java; Sulawesi; new species.

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All species of *Procordulia* Martin of the western part of Malesia are assigned to an apparently monophyletic group, the so-called ‘*sambawana*’ group. *P. sambawana* Foerster was formerly considered a widespread, although rather variable species (e.g. Liefstinck 1930) in which possibly several geographical races could be distinguished. Later, Liefstinck (1977: 165) provisionally split off the Javan specimens for which the name *P. karnyi* Fraser was available. Although this observation was cryptically published without comment, this opinion was followed in the recent checklist by Davies & Tobin (1985), but not by Tsuda (1991). Liefstinck also mentioned the existence of two undescribed species on Sulawesi (Celebes) (Liefstinck 1977: 167). All further studies on Corduliidae by Liefstinck remained, however, unfinished and unpublished.

In the present paper descriptions or diagnoses of eight species from the Lesser Sunda Islands, Java, Sumatra, Borneo, Sulawesi (Celebes) and Mindanao, are provided. Three species are described as new to science. This paper focuses on the species of western Malesia, although also new species from New Guinea are available in various collections. Also, a first attempt is made to understand the relationships of the Malesian Corduliidae at a higher level. A more detailed analysis of the species groups now united in *Procordulia*, and a general discussion of the Indo-Australian genera of Corduliidae, has to await the de-

scriptions of new Papuan representatives of *Procordulia* and *Hemicordulia*. Finally, the biogeography of the western Malesian species is briefly discussed.

Abbreviations for museums and institutions follow the ‘codens’ in Arnett & Samuelson (1986).

### SYSTEMATIC PART

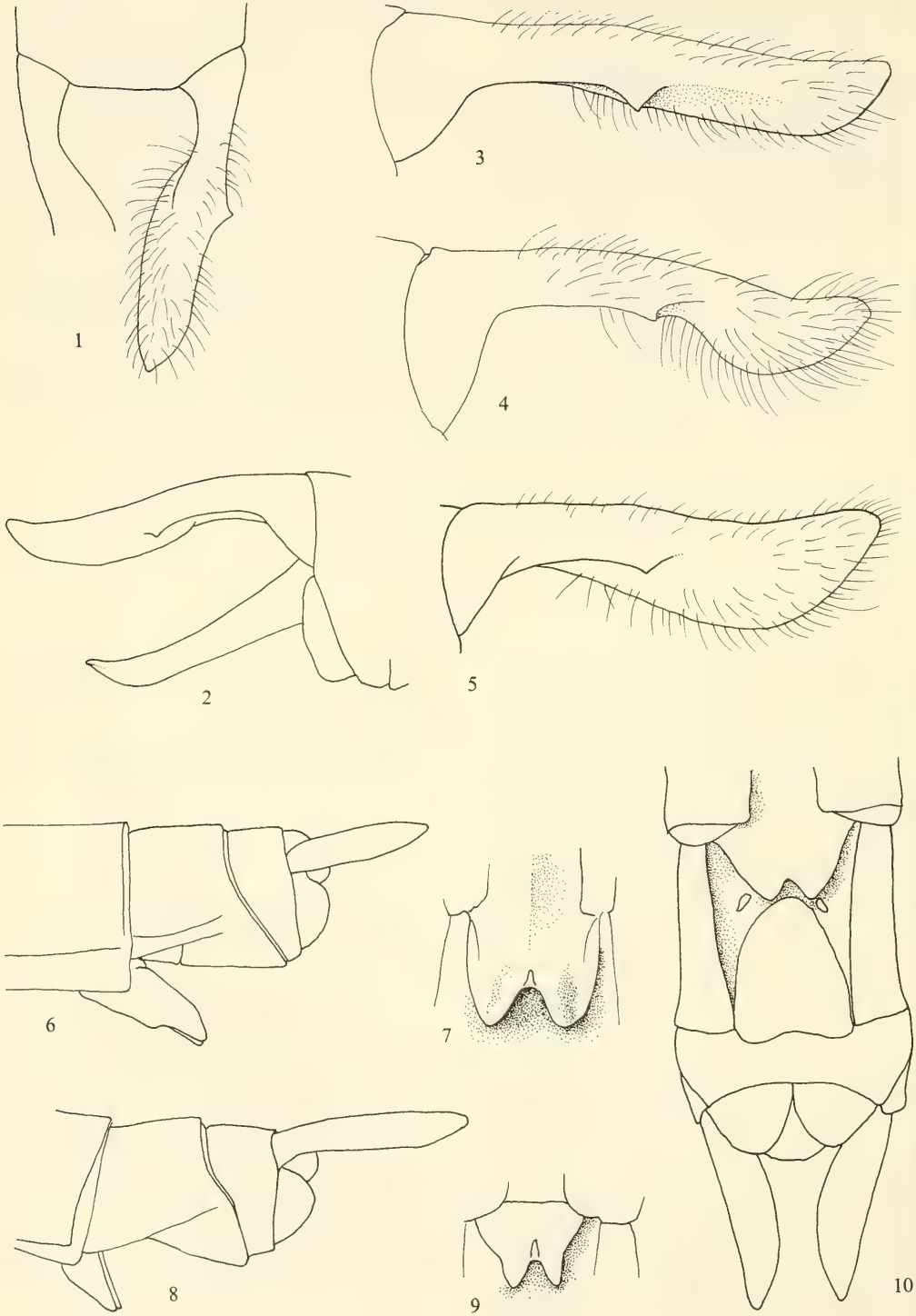
*Procordulia* Martin, 1907 [1906]

Type species. – *Cordulia affinis* Selys, 1871 [selected Ris 1910: 437].

The closely related genera *Hemicordulia* Selys and *Procordulia* can be distinguished (Martin 1907) by (a) the presence of auriculae in *Procordulia* (absent in *Hemicordulia*), (b) the presence of a cross-vein in the anal triangle of *Procordulia* (absent in *Hemicordulia*), and (c) a distinct anal angle in the hind wing of *Procordulia* (rounded in *Hemicordulia*).

The distinguishing characters of both genera are, however, not so clear (e.g. Watson et al 1991: 218) anymore, especially since the discovery of several intermediate forms in the Pacific. The status of both genera is further evaluated in the discussion section of this paper.





# Key to the males of western Malaysian species of *Procordulia*

1. Base of male superior appendage in lateral view distinctly separated from the main stem (figs. 3-4). Usually 6 Ax in hind wing ..... 2
- Base of male superior appendage in lateral view smoothly continuing into the main stem. Characteristically 5 Ax in hind wing ..... 6
2. Males with two Cux in hind wing, the distal Cux forming an infratriangle (fig. 24). Superior appendage with sharp lateral tubercle. Lesser Sunda Islands, Mindanao and ? Sulawesi ..... 3
- Males with one Cux in hind wing. Superior appendage with or without lateral tubercle. Java and Sulawesi ..... 4
3. Superior appendage very long and slender, c. 2.8 mm (fig. 3). Hind wing 35-37 mm. Lesser Sunda Islands ..... *P. sambawana* (Foerster)
- Superior appendage more robustly built with tip club-shaped. Hind wing 40 mm. Mindanao ..... *P. moroensis* Lief tinck
4. Lateral tubercle on superior appendage approximately in the middle and sharp (fig. 4). Hind wing characteristically with 5 Ax and 7 Px. Sulawesi ..... 5
- Superior appendage without lateral tubercle (fig. 12). Hind wing characteristically with 6 Ax and 8 Px ..... *P. karnyi* Fraser
5. Superior appendage in lateral view slender (fig. 4), with lateral tubercle hardly visible in dorsal view (fig. 17) ..... *P. lompobatang* sp. n.
- Superior appendage in lateral view relatively robust (fig. 5), with lateral tubercle conspicuous in dorsal view (fig. 18) ..... *P. rantemario* sp. n.
6. Superior appendage with a subterminal, bluntly shaped tubercle (fig. 14). Java ..... *P. papandayanensis* sp. n.
- Superior appendage straight, with a lateral carina, but without a tubercle (figs. 15-16) ..... 7
7. Abdomen fusiform, relatively short. Hind wing 32-33 mm. N Borneo ... *P. fusiformis* Lief tinck
- Abdomen only somewhat constricted at segment 3. Hind wing 34-35 mm. Java ..... *P. artemis* Lief tinck

## *Procordulia artemis* Lief tinck (figs. 15, 19, 28)

*Procordulia artemis* Lief tinck, 1930: 159-162, figs. 23-25 [original description, habitat]. Lectotype: Kawah Kamodjan. 19.iv.1930. Lft. in RMNH [examined]. – Lief tinck 1933: 399-429 [biology, descriptions]; Lief tinck 1934: 431-432 [material, habitat, habits, oviposition]; Lief tinck 1971: 75 [lectotype designation]; Lief tinck 1977: 164 [compared with *P. fusiformis*].

Diagnosis. – Small and slender species. Male with superior appendage slender, in lateral view in the middle hardly wider than at base; base not conspicuously heavier, tip not club-shaped (figs. 15, 19). Arculus in forewing approximately midway between Ax1 and Ax2. One Cux. Female with cylindrical abdomen without swollen basal segments. Appendages c. 1.8 mm. Genital valve short, projecting caudad from sternite 8, c. 1/4 of the length of segment 9, shorter than wide, margin with V-shaped excision with a depth of c. 1/4 of length of valve.

Apparently closely allied to *P. fusiformis*, which, however, has a conspicuous spindle-shaped abdomen. Superior appendages of both species very slender, without lateral tubercle; those of *artemis* c. 7-8 times as long as width in middle, and with acute tip in dorsal view (fig. 19), those of *fusiformis* c. 6 times as long as width in the middle, with a sharp tip (fig. 22).

Ecology. – Lief tinck (1933) provides an interesting account of the ecology of this species. Larvae were found in swamps and crater lakes.

Remark. – Locality data of the lectotype as given by Lief tinck (1971) are a free interpretation of the data actually available with the specimen. This method was also followed for many species.

Material examined. – Long series from Java (RMNH).

Distribution. – Java, South Sumatra.

## *Procordulia fusiformis* Lief tinck (figs. 16, 22, 28)

*Procordulia fusiformis* Lief tinck, 1977: 162-164, fig. 3 [original description, distribution].

Diagnosis. – Small size and spindle-shaped abdomen distinguish this species from other *Procordulia*

Figs. 1-10. *Procordulia* species. 1-3, *P. sambawana*, 4, *P. lompobatang*, 5-10, *P. cf. lompobatang*. – 1, anal appendages of male holotype, dorsal view; 2, idem, right lateral view; 3, superior appendage male, left lateral view; 4, superior appendage male, left lateral view; 5-7, female Bulluballija, abdomen left lateral view, dorsal view, and valvula vulvae in ventral view; 8-10, female Loka, abdomen left lateral view, dorsal view and valvula vulvae in ventral view.

species (Liefstinck 1977).

Male with superior appendage (figs. 16, 22) slender, but not as straight as in *P. artemis*; base somewhat heavier, top straight, not club-shaped, without lateral tubercle. Arculus in forewing about midway between Ax1 and Ax2. One Cux in hind wing. Apparently most closely related to *P. artemis* (see under that species).

Material examined. – N. Borneo. Mt. Kinabalu. Mesilau Camp. 4.iv.1964. 5000 ft. Coll. S. Kueh, 1 ♂ paratype (in RMNH, ex BMNH).

Distribution. – Northern Borneo (Sabah, ? Sarawak).

### *Procordulia karnyi* Fraser

(figs. 11-13, 21, 26, 28)

*Procordulia karnyi* Fraser, 1926: 472-473 [original description, ♂ ♀ Java, Mt. Tengger]. – Liefstinck 1930: 162-164 [type discussed]; Liefstinck 1971: 95 [lectotype designated: Mts. Tengger, 1200 m, 8 Dec 1920, H. Docters van Leeuwen]; Davies & Tobin 1985: 65 [specific status]; Tsuda 1991: 225 [as synonym of *P. sambawana*].

*Procordulia sambawana* [pro parte]. – Liefstinck 1953: figs. 58-59 (and ? 60) [♂ anal appendages, genitalia, # last abdominal segments].

### Description

Male adult. – A relatively large and robust *Procordulia*. Head densely setose, darkbrown at upperparts. Labrum pale yellowish white, mandibles and labrum pale brown; clypeus olive-brown with pale coloured transversal depression against labrum. Frons brownish with bilobed upper parts with blue-green metallic shine, coarsely punctate. Depressions between frons and vertex deep; vertex high, truncated, punctulate, metallic green; occiput dark brown, slightly convex behind, shining. Eyes brown in dried specimens.

Synthorax rather robust, brilliant metallic green, areas against sutures more brownish without metallic shine, synthorax covered with long, slender, creamish white setae; ventral side of thorax and spaces between wings light brown. Legs long and slender; trochanters, fore femur and posterior side of middle and hind femur brown, legs otherwise dark brown. Wings almost hyaline with a very slight yellowish tint covering the whole surface, colouring somewhat more conspicuous at wing tip and wing base; veins dark brown. Neuration rather similar to that in *P. sambawana*; pterostigma oblique, in fore and hind wing 2.0 mm wide; membranula brownish grey, paler part at wing base intermediate between that of *P. sambawana* and of *papandayanensis* (fig. 26). Nodal index in forewing 6.8 | 9.6 or 6.9 | 8.7, in hind wing 8.5 | 6.8 or 8.6 | 6.7. Forewing with one cross-vein in triangle, subtriangle three-celled; one Cux. Hind wing without cross-veins in triangle; one Cux, no subtri-

gle. Both wings without cross-vein in supratriangle, no supplementary bridge cross-vein at subnodus. Arculus oblique, in hind wing situated midway between Ax1 and Ax2. Anal angle of hind wing with distinct edge, anal triangle with a short vein in its apical third.

Abdomen slender, slightly constricted in the middle of segment 3, then gradually enlarged towards the end of segment 6, where it is broadest. Basal segments slightly swollen, much higher than wide, greatest width 3 mm. Segment 3-5 rounded above, then subtriangular in diameter, from about the middle of segment 6 to the middle of segment 9 with an indistinct median longitudinal crest. Venter flattened. Segment 10 with crest on dorsum. Auriculae small, knob-like, brown. Coloration dark bronzed-black, first three segments with distinct metallic green or coppery-red shine; middle segments with slight coppery-red reflex and segment 9-10 almost black. Dorsum of segment 1-2 covered with long setae. Sides of segment 1-2 and basal half of 3 very shining. Ventral sides of tergites dull brownish, their terminal fifth darkened. Accessory genitalia on segment 2 not very prominent, dark brown. Genital lobe subtriangular in general outline, with acute tip; posterior hamuli somewhat shorter than the lobe, thick at base, then constricted and considerably narrowed, strongly curved inwards, then outwards, straight in the median plane.

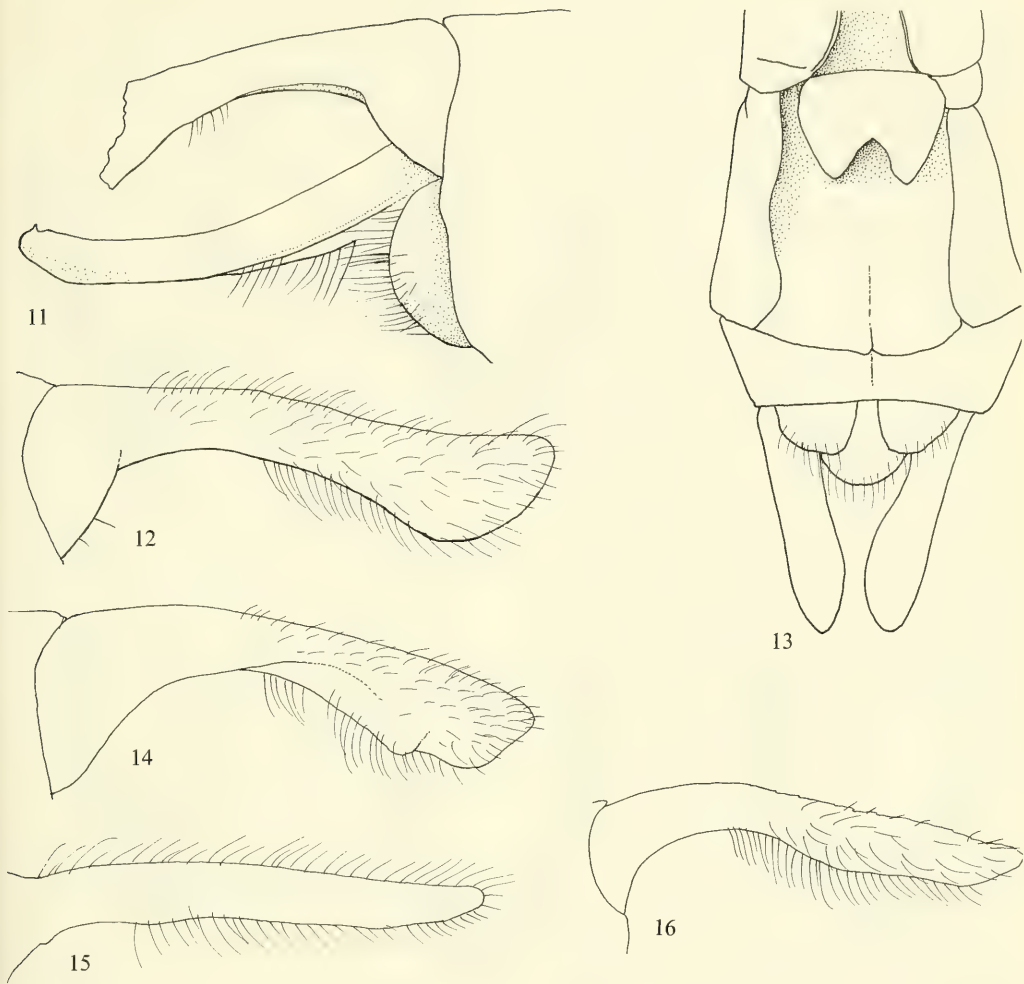
Anal appendages with superiors 2.75 mm long, in dorsal view (fig. 21) relatively slender at base, distal part club-shaped; base rather heavy, with a sudden transition between the base and the main stem; on stem no or hardly any trace of a lateral tubercle (figs. 11-12).

Female. – Similar to the male, but head more brownish, vertex brown without metallic shine. Wings generally with more conspicuous yellowish shine than male; nodal index forewing 5.9 | 9.6, hind wing 8.6 | 7.7. Hind wing with one Cux. Abdomen more robust than male, with purple shine. Basal segments slightly swollen; appendages c. 2.3 mm; genital valve projecting caudad from sternite 8, c. 1/3 the length of segment 9, somewhat shorter than wide with V-shaped excision c. 2/5 the length of the valve.

Differential diagnosis. – Males of *Procordulia* of Java can be distinguished by the shape of the superior appendage (figs. 11-12, 14-15). For distinguishing characters with *P. papandayanensis*, see under that species.

Ecology. – Possibly a species inhabiting running waters. The data of Liefstinck (1933, sub nom. *P. sambawana*) may or may not include material of *P. karnyi*. In the light of the records of adults taken in 1961 (see below), I presume that at least the ultimate larva from E Java (Mt. Lawoe, little fall near Serangan above Madioen, ca. 1300 m, 29 Sep 1927, leg. A.



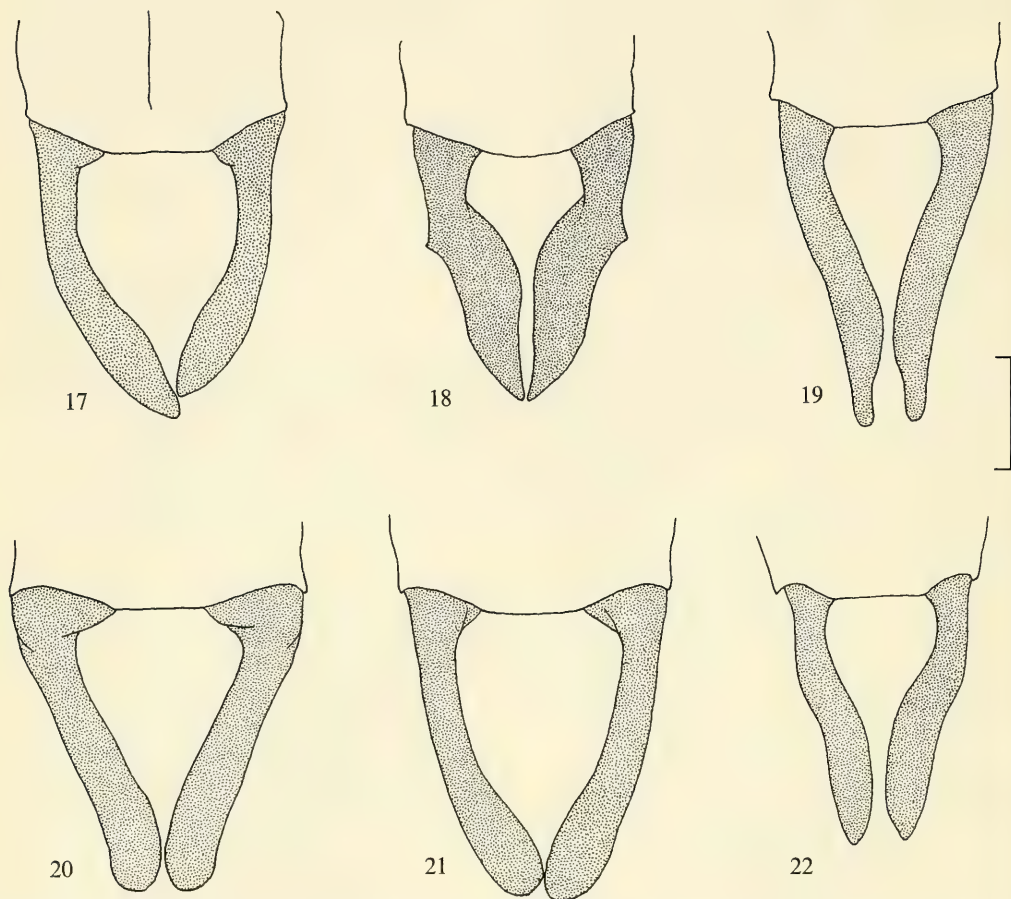


Figs. 11-16. *Procordulia* species. 11-12, 14-16, superior appendage of male in lateral view, 13, last abdominal segments of female. — 11, *P. karnyi*, holotype, right lateral view; 12-13, *P. karnyi*, Java, Baturraden; 14, *P. papandayanensis*, Java, Mt. Papandajan; 15, *P. artemis*, Java; 16, *P. fusiformis*.

Vorstman) can be attributed to *P. karnyi*.

Other material examined. — Java: E Java, Tengger Mts, 8 Dec 1920, H. D. v. L., 1♂ [lectotype] (RMNH); E Java, Tengger Mts, 6 Dec 1920, H. Docters van Leeuwen, 1♀ (BMNH) [not seen]; W Java, Preanger, Sitoe Lembang, 1600 m, Dec 1936, F. C. Drescher, 1♂ (BMNH); S Java, Mt. Tangkuban Pahu, 1300-1400 m, 1♂ (BMNH, ex coll. Liefstinck); Batoerraden, Mt. Slamet, ca. 2500 ft, F. C. Drescher, 27 Dec 1927, 19 Apr 1929, 2 Apr 1930, 3♂ 1♀

(BMNH, ex coll. Liefstinck); Java occ., H. Fruhstorfer, 3♂ 1♀ (Museum Berlin) [not seen]; W Java, Situ Lembang, 1600 m, Dec 1936, F. C. Drescher, 5♂ (RMNH); W Java, slopes of Mt Gedeh and Pangrango, series of both sexes (RMNH); Mt. Patuha, Patuhawattee, 1750 m, 3 Jun 1935, J. van Marle, 1♀ (RMNH); E Java, Mt. Ardjuno, Djunggo, 1600 m, Jan 1936, M. E. Walsh, 1♂ (RMNH); E Java, Mt. Lawu, 2000 m, Tjemorsewu, 24 Feb 1961, 'Vole en forêt vierge très près du sol, vol rapide, capture difficile,



Figs. 17-22. Superior anal appendages of male *Procordulia*. – 17, *P. lompopatang*; 18, *P. sambawana*; 19, *P. artemis*; 20, *P. pandayanensis*; 21, *P. karnyi*; 22, *P. fusiformis*. Scale bar 1 mm.

semble ici assex commune', P. Jauffret, 1♂ 1♀ (RMNH, ex coll. A. Heymer). – Sumatra. W Sumatra, Lebong Tandai, 1920-23, C. J. Brooks, 1♂ (headless) (BMNH); Central W Sumatra, Mt. Dempo, Gunung Agung Estate, 1500-2000 m, 11 Sep 1941, W. C. Verboom, 1♂ (bred from larva, emerged Bogor 2 Jan 1942) (RMNH).

Distribution. – Java, Sumatra.

*Procordulia lompopatang* sp. n.  
(figs. 4-10, 17, 23, 28)

*Procordulia irregularis* Martin, 1907 [1906]: 16-17 [original description] [partim, male Celebes only].

? *Procordulia sambawana*. – Martin 1907 [1906]: 17 [partim].

*Procordulia sambawana*. – Lieftinck 1953: figs. 63-64 [♂ anal appendages].

*Procordulia celebensis* Lieftinck, ms name.

Type material. – Holotype ♂: 'H. Fruhstorf. Celebes mer.' [white, round, handwritten], '*Neonyx nitens*' [white, handwritten in unknown hand], '*Procordulia sambawana* (Frst) / det vdW[eele]' [white with black margin, handwritten], 'det MA Liefstinck 75 / *Procordulia celebensis* Liefst. / holotype' [white, partly in print], 'RMNH Leiden / *Procordulia lompobatang* Van Tol / det. J. van Tol, 1988' [white, partly in print], 'Holotype' [red, in print] in RMNH. – Paratypes: Lansbg Celebes ?, 1 ♂ in IRSN [this specimen is also a paralectotype of *Procordulia irregularis* Martin]; Celebes mer, 1 ♂ (Fruhstorfer) in RMNH; S Celebes, Lompa Battau, 3000', Mar 1896, 4 ♂ (Fruhstorfer) in MNHN; SW Celebes, Mt Lompobatang, Parasalawaki, 1600-1650 m, 3, 4 and 8 Jul 1936, 3 ♂ (L. J. Toxopeus) in RMNH; S Celebes, Kanrapia, 3 km E of Buluballija, 2000 m, 30 Oct 1965, 2 ♂ (R. Straatman) in RMNH; SW Celebes, Lompobatang complex, 1100 m, Malino resthouse, 2 Jun 1982, 1 ♂ (M. A. Liefstinck) in RMNH.

Other material. – Celebes mer, 1 ♀ (Fruhstorfer) in RMNH; S Celebes, Lompa Battau, 3000', Mar 1896, 1 ♀ (Fruhstorfer) in MNHN; S Celebes, Loka, Mt Lompobatang, 1200 m, May 1949, 1 ♀ (C. Franssen) in RMNH; S Celebes, 82 km ESE of Makassar, Buluballija, 1700 m, 12 Oct 1965, R. Straatman, 1 ♀ (R. Straatman) in RMNH.

I have also examined in SMFD Frankfurt 11 ♂ and 2 ♀, with various labels (nos. O-37065 to O-37075, 37104 and 37100, ex collection Ris), but probably all belonging to the series collected by H. Fruhstorfer on the Lompobatang in March 1896. I have not examined these specimens since 1986, and thus did not include them in the type series. I have not included any females in the paratype series, since at least two types of females can be distinguished (see below). It is not clear whether one or more species are involved.

## Description

Male adult, holotype. – A relatively large and robust *Procordulia*. Head densely setose, dark brown at upper parts. Labium pale yellowish white, mandibles and labrum yellowish, labrum with subtriangular, olive-brown basal marking; clypeus olive-brown. Frons yellowish with the bilobed upperparts with blue-green metallic shine, coarsely punctate. Depressions between frons and vertex deep; vertex high, truncate, punctulate, metallic green; occiput dark brown, slightly convex behind, very shining. Eyes brown in dried specimens.

Synthorax rather robust, brilliant metallic green, covered with long, slender, creamish white setae; ventral side of thorax and spaces between wings light brown. Legs long and slender, trochanters and anterior side of fore and middle legs brown; legs otherwise dark brown. Wings almost hyaline with a very slight

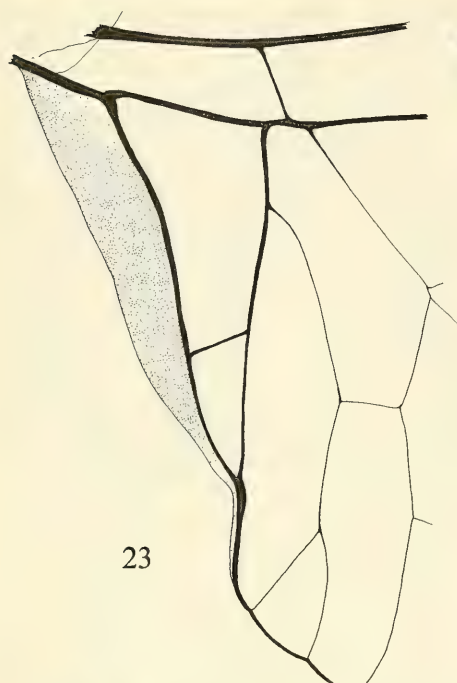
yellowish tint covering the whole surface, although somewhat more conspicuous towards the wing base. Neuration very similar to that in *P. sambawana*; neuration dark brown; pterostigma oblique, in fore and hind wing 1.85 mm wide; membranula brownish grey, somewhat lighter at extreme base. Nodal index of holotype fore wing 6.8 | 8.6, hind wing 7.5 | 5.7. Fore wing with one cross-vein in triangle, subtriangle three-celled; one Cux. Hind wing without cross-veins in triangle; one Cux (no subtriangle). Arculus oblique, in hind wing in all specimens situated midway between Ax1 and Ax2. Anal angle (fig. 23) in hind wing with distinct edge, triangle with a short vein in its apical third. Membranula dark-grey, only somewhat paler at its very base.

Abdomen slender, slightly constricted in the middle of segment 3, then gradually enlarged towards the end of segment 6, where it is broadest. Basal segments slightly swollen, much higher than wide, greatest width 3.25 mm. Segment 3-5 rounded above, then subtriangular in diameter, from about the middle of segment 6 to the middle of segment 9 with an indistinct median longitudinal crest. Venter flattened. Segment 10 with crest on dorsum. Auriculae small, knob-like, brown. Coloration dark bronzed-black, first three segments with distinct metallic green shine; middle segments with slight coppery-red reflex and segment 9-10 almost black. Dorsum of segment 1-2 covered with long setae; sides of segment 1-2 and basal half of 3 very shining. Ventral sides of tergites dull brownish, their terminal fifth darkened. Accessory genitalia on segment 2 not very prominent, dark brown. Genital lobe subtriangular in general outline, with acute tip; posterior hamuli of about equal length as the lobe, thick at base, then constricted and considerably narrowed, strongly curved inwards, then outwards, straight in the median plane.

Anal appendages with superiors 2.9 mm long, in dorsal view (fig. 17) relatively slender at base, distal part more knob-like; a small tubercle just visible about halfway in lateral view (fig. 4), the distal part beyond the tubercle somewhat widened, especially at ventral side.

Female. – Generally as male. Head as male, but vertex with metallic shine; occiput castaneous. Synthorax as male; hind wings in teneral specimens with yellow tint, adult female wings brownish yellow, especially against the wings. Neuration very similar to *P. sambawana*, including two Cux in the hind wing (only one female with one Cux in left hind wing); frontal side of pterostigma 2.5 mm (Loka) or 2.0 mm (Buluballija); arculus oblique, in hind wing midway between Ax1 and Ax2. Abdomen stoutly built, hardly constricted. Genital valve and appendages with much variation between the specimens. Loka specimens (figs. 8-10) with genital valve protruded from





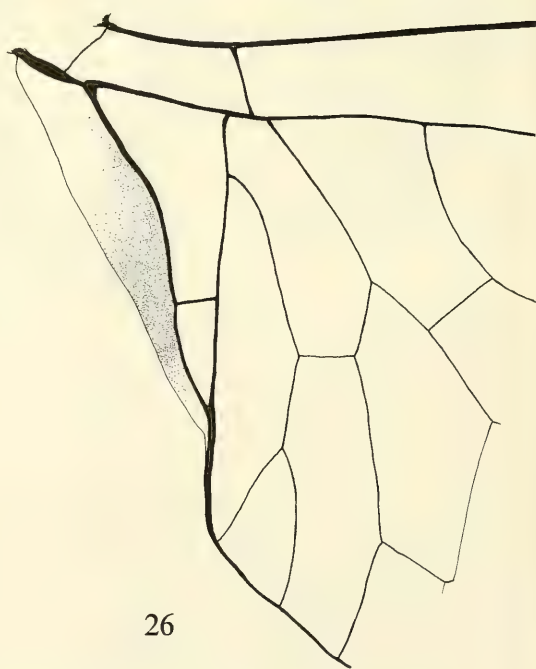
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24



25



26

Figs. 23-26. Base of hind wing of male *Procordulia*. – 23, *P. lompobatang*; 24, *P. sambawana*; 25, *P. papandayanensis*; 26, *P. karnyi*.

abdomen with angle of 60°, length c. 1/2 of segment 9, V-shaped excision c. 1/3 of valve; anal appendages long and slender, 2.7 mm. Buluballija specimen (figs. 5-7) with much larger valve, 2/3 the length of segment 9, V-shaped excision less deep; anal appendages straight and shorter, 1.8 mm long.

Ecology. – A species of mountainous areas.

Distribution. – SW Sulawesi (Celebes) (fig. 28).

*Procordulia moroensis* Lieftinck  
fig. 28

*Procordulia moroensis* Lieftinck, 1977: 164-167, figs. 4-5 [original description, distribution Mindanao]. Holotype ♂, Mindanao I., Upper Eden, 1000 m, 2.xi.1965 (in USNM) [not examined].

Diagnosis. – Adequately described by Lieftinck (1977).

Remarks. – In the original description, Lieftinck (1977) notes that 'this stout species approaches the two *Procordulia* occurring in Celebes, both of the *P. sambawana* group, ...'. In the characters used here it stands apart from the Sulawesi species by the 6 Ax veins in the hind wing. The superior anal appendages are indeed very similar to the Sulawesi taxa. Remarkably, it seems to be especially close to *P. rantemario*, which was unknown to Lieftinck. In lateral view, however, the superiors are quite different, in *P. moroensis* more or less club-shaped, and *P. rantemario* smoothly widening nearly from the base. *P. rantemario* is also c. ten percent smaller than *P. moroensis*.

*Procordulia papandayanensis* sp. n.  
figs. 14, 20, 25, 28

? *Procordulia sambawana*; Lieftinck 1933: 429 [larvae] [at least part of the material was collected on sites where the present species has been found].

Type material. – Holotype ♂: 'W Java, 2250 m / Mt. Papandajan / pondok, 9.vii.1934 / M. A. Lieftinck', with on reverse side '*P. sambawana* / dt. Lieftinck' [white label, both texts in Lieftinck's hand], 'Museum Leiden / ex verz. M. A. Lieftinck' [printed], 'Holotype' [red, printed], 'RMNH Leiden holotype / *Procordulia papandayanensis* Van Tol / det J. van Tol, 1996' [partly printed, partly handwritten] [JvT 6787]. – Paratypes: All specimens from W Java. Gunung Gedeh, c. 2000-2600 m, 11♂; Gunung Papandajan, 2300-2600 m, 7♂; Gunung Tangkuban Prahur, 1400 m, 1♂ (all RMNH); W Java, Mt. Papandajan, 5000 ft, 23 Nov 1929, 1♂ (C. Longfield) in BMNH (det. *P. sambawana* by C. Longfield).

## Description

Male. – A relatively large and robust species of *Procordulia*, stouter than *P. sambawana*, although with some variation. Head densely setose, dark brown at upperparts, paler otherwise. Labium and mandibles pale yellowish white, labrum more brownish. Clypeus olive-brown with a rectangular, paler depression along labrum. Frons light to olive-brown, or dark yellowish, with the bilobed upperparts with blue-green metallic shine, coarsely punctate. Depression between frons and vertex deep; vertex high, truncated, punctulate, with only inconspicuous metallic green shine, less than in other species; occiput chestnut brown, slightly convex posteriorly, very shining, densely setose, rear side with a dense fringe of long setae. Eyes brown in dried specimens.

Synthorax robust, metallic green lees brilliant than related species, covered with long, slender, creamish white setae; ventral side of thorax and spaces between wings light brown. Legs long and slender, trochanters brown, legs otherwise dark brown. Wings almost hyaline with a yellowish tint covering the whole surface, especially near the wing base. Neuration dark brown; pterostigma oblique, in fore and hind wing c. 2.0 mm wide; membranula off-white, darker posteriorly. Nodal index fore wing 6.8 | 8.6, in hind wing 7.5 | 5.7 in nearly all specimens. Fore wing with one cross-vein in triangle, supratriangle without cross-veins, subtriangle three-celled, one Cux. Hind wing without cross-veins in triangle and supra-triangle; one Cux. Arculus oblique, in hind wing in all specimens situated midway between Ax1 and Ax2. Anal angle (hind wing) with distinct edge; anal triangle with a short vein in its apical third. Supplementary bridge cross-vein at subnodus.

Abdomen more robust than in *P. sambawana*, slightly constricted in the middle of segment 3, then gradually somewhat enlarged toward the end of segment 6, where it is broadest. Basal segments slightly swollen, much higher than wide, greatest width 3.2 mm. Segment 3-5 rounded above, then subtriangular in diameter, from about the middle of segment 6 to the middle of segment 9 with an indistinct median longitudinal crest. Venter flattened. Segment 10 with crest on dorsum. Auriculae small, knob-like, brown. Coloration dark bronzed-black, first three segments with metallic shine greenish or coppery-red; middle segments with slight coppery-red reflex and segment 9-10 almost black. Dorsum of segment 1-2 sparsely covered with long setae. Sides of segment 1-2 and basal half of 3 very shining. Ventral sides of tergites dull brownish, their terminal fifth darkened.

Accessory genitalia on segment 2 not very prominent, dark brown. Genital lobe subtriangular in general outline, with acute tip; posterior hamuli somewhat shorter than the lobe, thick at base, then

constricted and considerably narrowed, strongly curved inwards, then outwards, straight in the median plane.

Anal appendages with superiors 2.5 mm long in dorsal view; in dorsal view (fig. 20) relatively slender at base, slightly widening from base to apex, the tips somewhat curved outwards; in lateral (fig. 14) view transition of base to stem smooth without distinct angle, at c. 1/4 from the top a bluntly shaped ventral tubercle; top club-shaped.

Female. – Unknown.

Differential diagnosis. – The males of *Procordulia* species of Java can be distinguished by the shape of the superior appendage. In *P. papandayanensis* the top is more or less club-shaped with a sub-terminal ventral blunt tubercle, which is absent in the other species. In *P. karnyi* the appendage is rather robust, while the transition of the base to the stem is characteristically distinct as in *P. sambawana*. The appendage of *P. artemis* is much more slender and tubiform.

Distribution. – Java, where it seems to be confined to higher altitudes.

*Procordulia rantemario* sp. n.  
(figs. 5, 10, 18, 28)

Type material. – Holotype ♂: Indonesia. SW Sulawesi. 30 km NE of Enrekang. SW slope of Gn Rantemario. Sg. Gowa Sarumpa'pa at Gowa camp (Pos 2). Fast flowing stream, rapids, ponded sites. Primary rain forest. Shade; w=3-5 m, d=10-30 cm. Altitude 1800 m. 3°24'15"S 120°00'30"E. 6-9 Nov 1993. Leg. J. van Tol [JvT no 1730] (in RMNH). – Paratypes 1♂ 3♀, same data [JvT 1731-1734] (1♂ 1♀ in MBBJ, other specimens in RMNH).

## Description

A relatively small and slender representative of the *P. sambawana* group.

Male. – [JvT 1730]. Head and thorax densely setose. Head: Labium yellowish white, mandibles and labrum yellowish, labrum with subcircular brown base, rest orange-yellow; frons olive-brown with bilobed dorsal parts brownish black with blue-green metallic shine, coarsely punctate; depression between frons and vertex deep; vertex brown with hardly detectable metallic shine, high, truncate, punctate; occiput brown, slightly convex, finely punctulate. Eyes in dried specimens dark green below and brown above.

Synthorax slender, greenish with blue metallic shine; ventral side of thorax pale brown. Legs long and slender; trochanter of fore and middle leg and anterior side of trochanter of hind leg middle brown;

anterior side of femora middle brown (in hind leg reduced to longitudinal stripe); remaining parts of legs brownish black. Wings hyaline with very slight yellowish tint; anal triangle and cubital space of hind wing with dark yellow tint; neuration similar to *P. sambawana*, nervature dark brown, pterostigma oblique, in fore and hind wing anteriorly approximately 1.9 mm wide; membranula isabel coloured at base, more brownish near apex; nodal index fore wing 6.8 | 9.5, hind wing 7.5 | 5.6; triangle of fore wing with one cross-vein, subtriangle three-celled, one Cux; triangle of hind wing without cross-vein, one Cux (no subtriangle); Arculus oblique, in fore wing closer to Ax2 than to Ax1; anal angle in hind wing with distinct edge, anal triangle with short vein in its apical third.

Abdomen slender, slightly constricted at the middle of segment 3, then gradually enlarged towards the end of segment 6, where it is broadest. Segments 2-9 with conspicuous green metallic shine; basal segments slightly swollen, higher than wide; from segment 4-9 with lateral carina, making segments triangular in diameter; from middle of segment 4 to middle of segment 10 with (especially rostrally rather inconspicuous) dorsal carina, base of segment 10 with conspicuous crest; auriculae small, knob-like, brown; coloration segments 1-9 bronzed black with green metallic shine on all segments, but segment 10 rather dull and hardly metallic; dorsum of segment 1-2 with long setae; dorsal sites of tergites with brownish yellow markings against lateral carina, more or less central on segment 4, covering anterior three-quarters of segments 5-7, basal half of segment 8 and basal quarter of segment 9; ventrum most light brown. Accessory genitalia on segment 2 not very prominent, dark brown; genital lobe elongate subtriangular, more straight than in *P. lompopatang*, tip acute; posterior hamuli in ventral view of about the same length as the lobe, solid at base, then constricted and considerably narrowed, curved inwards, the tip curved outwards as well as towards the body. Anal appendages with superior approximately 2.5 mm long, in dorsal view (fig. 18) much more robust than in *sambawana* or *lompopatang*, basal half more or less straight up to a conspicuous extero-lateral tooth; the distal half curved inwards, only somewhat widening with distal one-third approximately parallel; in lateral view (fig. 5) with conspicuous edge at base (as in *lompopatang*), side margin running distally in lateral tooth, knob-like distal part conspicuously widening, starting proximally to lateral tubercle; inferior appendage rather short.

Measurements: Hind wing 36 mm; abdomen incl. appendages 36 mm.

Variation: Male paratype has wing formula forewing 5.8 | 8.5, hindwing 7.5 | 5.7. Other characters similar as in holotype.



Female. – Generally as the male, but much more robust. Head as male, but labium rather pale, yellowish white; wings hyaline without conspicuous yellow tint; neuration similar to male, also one Cux in hind wing (compare *P. lompoatang*); frontal side of pterostigma ca. 2.0 mm; Arculus oblique, in hind wing halfway between Ax1 and Ax2. Abdomen rather stout, only somewhat constricted at posterior half of segment 3 and base of segment 4. Genital valve rather short, covering approximately two-fifths of entral side of segment 9, emarginate with emargination approximately one-third of length of valve; anal appendages straight, ca. 2 mm.

Etymology. – Rantemario, name of the mountain of the type locality; a noun in apposition.

Distribution. – Only known from the type locality, Gn. Rantemario, one of the tops in the Latimojong mountains.

*Procordulia sambawana* (Foerster)

figs. 1-3, 18, 24, 28

*Somatochlora sambawana* Foerster, 1899: 64-65 [holotype ♂, Insel Sumbawa / zwischen Floris / u. Sumba / d. Pagenstecher don. 1898] [UMMZ, examined].

*Procordulia sambawana* (Foerster). – Liefstinck 1936: 148-149 [material Lombok and Sumba only]; Liefstinck 1953: 191-193, figs. 61-62 [partim, only records Lesser Sunda Islands] [references, material Sumbawa, geographical variation]; Liefstinck 1954: 122 [partim, only specimens Lesser Sunda Islands] [synonymy, range, ecology].

*Procordulia sambawana* (Foerster) [incorrect emendation]; Martin 1907: 17 [partim, only records Lesser Sunda Islands]; Liefstinck 1930: 162-164 [partim, only records Lesser Sunda Islands] [comparison with *P. artemis*].

Other material examined. – Lesser Sunda Islands, W Flores, Rana Mese, 1300 m, 5-8 Apr 1958, A. M. R. Wegner, 9♂ (RMNH); Soemba, Fruhstorfer, 1♂ (IRSN); Insel Sumbawa bei Flores, 1898, Dr. A. Pagenstecher, 1♀ (UMMZ) [with Cux 2 | 1]; Lombok, Sambalun, 4000', Apr 1896, H. Fruhstorfer, 1♀ (RMNH). – [Doubtful record]: Celebes, Bua Kraeng, 5000 ft, Feb 96, Fruhstorfer, 1♂ (BMNH) [with Liefstinck's label 'P. spec. nov. Celebes'].

Liefstinck examined: Lombok, Sapit 2000', Apr 1896, H. Fruhstorfer, 2♂ 1♀ (ZMHB).

**Description**

Male. – A relatively large and robust *Procordulia*, although with some variation. Head densely setose, dark brown at upperparts, paler otherwise. Labium and mandibles pale yellowish white, labrum more brownish. Clypeus olive-brown with a rectangular, paler depression along labrum. Frons light brown or dark yellowish with the bilobed upperparts with blue-green metallic shine, coarsely punctate, Depressions between frons and vertex deep; vertex high, truncat-

ed, punctulate and hardly shining, metallic green; occiput chestnut-brown, slightly convex posteriorly, very shining, rear side with a dense fringe of long setae. Eyes brown in dried specimens.

Synthorax relatively slender, brilliant metallic green, covered with long, slender, creamish white setae; ventral side of thorax and spaces between wings light brown. Legs long and slender; trochanters and anterior side of fore and middle legs brown; legs otherwise dark brown. Wings almost hyaline with a very slight yellowish tint covering the whole surface. Neuration with nervature darkbrown; pterostigma oblique, in fore and hind wing c. 2.0 mm wide; membranula brownish grey, off-white in basal 1/6th. Nodal index in fore wing 6.9 | 9.6, in hind wing 9.6 | 5.8 or 8.6 | 6.8. Fore wing with one cross-vein in triangle, supratriangle without cross-veins, subtriangle three-celled, one Cux. Hind wing without cross-veins in triangle and supra-triangle; characteristically with two Cux. Arculus oblique, in hind wing in all specimens situated in the middle between Ax1 and Ax2. Anal angle (hind wing) with distinct edge; triangle with a short vein in its apical third. Supplementary bridge cross-vein at subnodus.

Abdomen slender, slightly constricted in the middle of segment 3, then gradually somewhat enlarged towards the end of segment 6, where it is broadest. Basal segments slightly swollen, much higher than wide, greatest width 2.75 mm. Segment 3-5 rounded above, then subtriangular in diameter, from about the middle of segment 6 to the middle of segment 9 with an indistinct median longitudinal crest. Venter flattened. Segment 10 with crest on dorsum. Auriculae small, knob-like, brown. Coloration dark bronzed-black, first three segments with distinct metallic green shine; middle segments with slight coppery-red reflex and segment 9-10 almost black. Dorsum of segment 1-2 sparsely covered with long setae. Sides of segment 1-2 and basal half of 3 very shining. Ventral sides of tergites dull brownish, their terminal fifth darkened. Accessory genitalia on segment 2 not very prominent, dark brown. Genital lobe subtriangular in general outline, with acute tip; posterior hamulus shorter than the lobe, thick at base, then constricted and considerably narrowed, strongly curved inwards, then outwards, straight in the median plane.

Anal appendages with superiors 3.5 mm long, in dorsal view relatively slender at base, widening at c. 1/5 from the base and distal 4/5th more or less straight; a sharp, tooth-like tubercle at about midway in lateral view.

Distribution. – Lombok, ? Sumba, Sumbawa, Flores, ? Sulawesi.

Differential diagnosis. – Can be distinguished from other species in this group by the virtually straight su-

perior anal appendage with a sharp lateral tubercle approximately midway, and the presence of two Cux in the hindwing.

Remarks. – The present data are insufficient to decide whether *P. sambawana* is indigenous to Sulawesi. It is not unlikely that the Sulawesi male mentioned above was mislabelled. Mislabelling of Indonesian material collected by Fruhstorfer is, unfortunately, common (see Van Tol 1987: 163). On the other hand, the collections of apparently genuine Sulawesi females of *Procordulia* are heterogeneous. All specimens have two Cux in the hind wing, a character occurring otherwise only in the males of *Procordulia sambawana*. Liefstinck considered the Sulawesi specimen distinct from *P. sambawana*, but I can not distinguish this specimen from material from the Lesser Sunda Islands.

## DISCUSSION

### Affinities of genera

Several efforts have been made in the past (e. g. Martin 1907, Liefstinck 1953, 1977) to understand the systematics of the genus *Procordulia* Martin and related genera, or the Corduliidae in general (Needham 1908, Williamson 1908). Nevertheless, the relationships of the corduliine genera, and those of the species included in *Procordulia* plus *Hemicordulia*, remain poorly understood (e.g. Watson 1981: 1148).

It is also unclear which character or characters are diagnostic for each genus. In the Pacific islands, the easternmost part of their ranges, both genera cannot be kept apart based on the characters used so far. Liefstinck (1977) also notes that females are difficult to assign to any of both genera. Besides, the species of the Australian region, particularly several included in *Procordulia* so far, differ from their Malesian congeners in many ways. Especially the position of the New Zealand *Procordulia grayi* (Selys, 1871), originally described in the genus *Cordulia*, subgenus *Epitbeca* and later included in *Somatochlora* by Martin (1907), has been questioned already several times (see Rowe 1987). The *Procordulia* species of Malesia, on the other hand, are quite uniform and presumably form a monophyletic group. Their pattern of speciation may contribute to our understanding of the biogeographical history of this region. Although a more detailed systematic and biogeographical analysis has to wait for the future when also the species of New Guinea, Australia and the islands in the Pacific have been included, a few notes may summarize our present state of understanding.

Most indo-australian Corduliinae are united in *Procordulia* and *Hemicordulia*. A few oriental species with obvious Palaearctic relationships are attributed

to *Cordulia* Leach, while several aberrant Malesian species are arranged in monospecific genera as *Antipodochlora* Fraser, *Guadalca* Kimmins, *Heteronaias* Needham & Gyger and *Pentatthemis* Karsch (see Watson 1969). The relationships of these genera are unknown, since they have been characterized by autapomorphies only. As noted above, the difference between the two genera that mainly concern us here is less distinct in the eastern parts of their ranges. *Hemicordulia mumfordi* Needham from the Marquesas Islands is remarkable in this respect, since it has a cross-vein in the anal triangle. Based on a preliminary cladistic analysis, it appears that this cross-vein, also being more oblique, is not homologous to that in *Procordulia*. For this analysis the South-American genus *Rialla* was used as outgroup. The choice of a remotely related outgroup in phylogenetic analysis is certainly not without problems, and the results of this cladogram have to be used with care.

The genus *Hemicordulia* is aberrant within the Corduliidae for two characters, viz. it lacks an angulated base of the male hind wing, as well as auricles (oreillets). The characters should be interpreted as autapomorphies. *Hemicordulia* is not restricted to Australia and Southeast Asia. *H. virens* (Rambur) occurs on Mauritius, *H. similis* (Rambur) on Madagascar and the Seychelles, while *H. asiatica* is widespread and known from Uganda, South India, Ceylon and Assam (Pinhey 1962). Fraser (1949) attributed the occurrence of *Hemicordulia* on the Mascarene islands and Madagascar to the strong migratory tendencies of some species. He also states that 'there is good evidence to show that they [*H. virens* and *H. similis*] are lineal descendents of *H. asiatica*'. Both remarks would be in support of an Indo-Australian origin of the genus, with westward migration in a later phase. The preliminary analysis seems to indicate that *Procordulia grayi* and *P. jacksoniensis* are not closely allied to *Procordulia* + *Hemicordulia* (as defined by their type species).

### Biogeographical notes

The distribution of the western Malesian species of *Procordulia* is illustrated in fig. 27. The genus is known from the southern tip of Sumatra, Java, Lombok, Sumba, Sumbawa and Flores, the southwestern peninsula of Sulawesi, the northern part of Borneo and the island of Mindanao. This distribution pattern may be compared with the comments on the biogeographical relationships between the Philippines and Sulawesi as summarized by Vane-Wright (1990) and of the relationship of microcontinents in this region by Michaux (1991, 1994, 1996). Relationship between Sulawesi and the Philippines have been proposed earlier by Wallace and by Croizat (1958), who suggested a relation between Sulawesi



Fig. 27. Distribution of western Malesian *Procordulia* species.

and the Philippines via Halmahera. Vane-Wright demonstrates the faunal regions of the Philippines, and postulates that the Philippines, rather than Sulawesi, will provide the key to our understanding of the evolution of Southeast Asia. His conclusion is that the Philippines have a derived Sunda Shelf fauna. Due to recent geological uplift the land area of the islands is considerably larger now than before. These conditions may have induced exchanges between faunal elements from the Philippines to Sulawesi and from Sulawesi to the Moluccas.

Studies of McCabe & Cole (1989), on the other hand, indicate that the Banda, Sulu and Celebes Sea are composed of old oceanic crust surrounded by younger, actively spreading oceanic crust. Michaux' conclusion of these data is, that western Sulawesi, eastern Borneo and parts of Mindano formed a single tectonic unit and share a common history. This microcontinent would be of Gondwanic origin, and have a collision age of (possibly) late Cretaceous.

Thirdly, also more recent climatic changes may have influenced the possibilities for dispersal of mountainous species. It is largely unknown what

kind of vegetation dominated during the Pleistocene glaciations, but lower sea levels may have opened corridors for species now confined to higher altitudes.

The relative close relationships of the species of the *P. sambawana* group, as based on morphological characters, suggest a Pleistocene rather than a Cretaceous time of splitting of the lineages.

#### ACKNOWLEDGEMENTS

This paper started on annotations by the late Dr. M. A. Liefinck. I have carefully re-examined and measured all specimens myself, and all conclusions in this paper are mine. I gratefully acknowledge the kind help and hospitality of Stephen J. Brooks (BMNH), and Mark O'Brien (UMMZ).

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# REVISION OF THE *RADHA* GROUP OF THE GENUS *PLATYLOMIA* STÅL, 1870 (HOMOPTERA, CICADIDAE)

HARVARD  
UNIVERSITY

Beuk, P. L. Th., 1998. Revision of the *radha* group of the genus *Platylomia* Stål, 1870 (Homoptera, Cicadidae). – Tijdschrift voor Entomologie 140 [1997]: 147–176, figs. 1–51, tab. 1. [ISSN 0040-7496]. Published 26 March 1998.

The name *radha* group is proposed for a monophyletic group of six species of the genus *Platylomia* Stål, 1870. The species are found in India, Bhutan, Nepal, Indo-China, Peninsular Thailand, China, and Taiwan. Five species are redescribed [*P. bivocalis* (Matsumura, 1907), *P. bocki* (Distant, 1882), *P. ficulnea* (Distant, 1892), *P. pendleburyi* Moulton, 1923, and *P. radha* (Distant, 1881)] and one species (*P. malickyi*) is described as new. *P. operculata* Distant, 1913, and *P. similis* (Distant, 1888) are brought into synonymy with *P. radha*. Lectotypes are designated for *Dundubia bocki*, *Cosmopsaltria ficulnea*, *P. operculata*, *D. radha*, and *D. similis*. A key to the males and distribution maps of the species are presented. The features characterising the *P. radha* group and the relations between the species in the group are briefly discussed.

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Key words. – *Platylomia*; *radha* group; phylogeny; taxonomy; new species; Southeast Asia.

The genus *Platylomia* was erected by Stål (1870) as a subgenus of *Cosmopsaltria* Stål, 1866, to accommodate the single species *Cicada flavida* Guérin-Ménéville, 1834, that was distinguished from the species of *Cosmopsaltria* sensu stricto by a broader thorax and more undulating lateral margins of the thorax. Distant (1905) raised *Platylomia* to generic level, redefined it and gave the following diagnosis: head as broad as or broader than anterior margin of mesonotum; head as long as or just shorter than distance between eyes; pronotum as long as distance between anterior margin of mesonotum and 'base' of cruciform elevation; lateral margin of pronotal collar always with a tooth that usually is pointed; abdomen much longer than length of head, pronotum and mesonotum; timbal organs completely covered; rostrum just reaching between to beyond posterior coxae; opercula curved to the lateral part of the abdomen, elongate with a proximal constriction and a rounded or attenuate apex; and tegmina and wings hyaline but often infusate on veins.

Based on these diagnostic characters, a large variety of species has been gathered in the genus *Platylomia*, notwithstanding the fact that not all species fully fit the diagnosis, and that a lot of variation can be observed in the structure of the genitalia (compare e.g. Hayashi 1978: fig. 24 [*P. saturata* (Walker, 1858)] and fig. 4 below).

The genus *Platylomia* is currently placed in the subtribe Dundubiaria of the tribe Dundubiini together with the genera *Orientopsaltria* Kato, 1944, *Dundubia* Amyot & Serville, 1843, *Macrosemia* Kato, 1925, *Meimuna* Distant, 1905, *Haphsa* Distant, 1905, *Ayesha* Distant, 1905, and *Khimbya* Distant, 1905 (Duffels & Van der Laan 1985). The genus contains about 35 species (Metcalf 1963; Duffels & Van der Laan 1985; Beuk 1996) from the Southeast Asian mainland, the Greater Sunda Islands, Sulawesi, and the Philippines. The genus has not yet been subject of a phylogenetic study and it is not clear whether it represents a monophyletic unit or not. However, it appears that at least some monophyletic groups within *Platylomia* can be recognised. In the present paper the species of one such group are revised and the '*Platylomia radha* group' is introduced to accommodate them. The group at present comprises six species (including one new) distributed with certainty in India, Bhutan, Nepal, Indo-China (Burma, Thailand, Laos, Cambodia, Vietnam), Peninsular Thailand, China, and Taiwan. Records from Japan could not be confirmed.

This paper is part of a study into the phylogeny and biogeography of *Platylomia* and the other genera of the Dundubiaria. The results from the phylogenetic reconstruction below are too preliminary to draw



any conclusions about the biogeography of this group.

#### MATERIAL AND METHODS

References in the literature to species treated below were checked whenever possible. Older references were traced using Metcalf (1963) and Duffels & Van der Laan (1985). References that could not be checked are marked with an asterisk (\*).

The following abbreviations were used for collections mentioned in the descriptions:

BMNH	Natural History Museum, London (former British Museum Natural History)
BPBM	Bernice P. Bishop Museum, Honolulu
CASC	California Academy of Sciences, San Francisco, California
FOYP	Forest Office of Yunnan Province, China
ISNB	Institute Royale des Sciences Naturelles de Belgique, Bruxelles
IZUI	Institut für Zoologie der Universität Innsbruck, Innsbruck
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
MNKM	Muzium Negara Malaysia, Kuala Lumpur
MNHN	Muséum National d'Histoire Naturelle, Paris
MSNG	Museo Civico di Storia Naturale 'G. Doria', Genova
NHMS	Naturhistoriska Riksmuseet, Stockholm
NSMT	National Science Museum (Natural History), Tokyo
NWAS	Museum of Entomology, North-western Agricultural University, Yangling, Shaanxi
OPU	Osaka Prefecture University, Osaka
SEMK	Snow Entomological Museum, Lawrence, Kansas
SUU	Saitama University, Urawa
TARI	Taiwan Agricultural Research Institute, Taichung
USNM	United States National Museum, Smithsonian Institution, Washington D.C.
UZMK	Universitets Zoologiske Museum, København
ZFMK	Zoologisch Forschungsinstitut und Museum Alexander Koenig, Bonn
ZMAN	Instituut voor Systematiek en Populatiebiologie (Zoologisch Museum), Amsterdam

The following geographical sources have been consulted: 'Andrees allgemeiner Handatlas' (Ambrosius 1921), 'Atlas van Tropisch Nederland' (Anonymous 1938), 'The Times Atlas of the World' (Anonymous 1994), 'Nelles Road Atlas Southeast Asia excluding Indonesia' (Anonymous 1992), 'Thailand, Indochina

& Burma Handbook' (Eliot et al. 1994), GEONET Names Server of the U.S. Defence Mapping Agency (WWW URL: <http://www.nima.mil/gns/html/index.html>). The locations of several collection sites of *L. Fea* were determined with Gestro (1904).

Arrows in illustrations point to certain important features mentioned in the descriptions or other parts of the text.

PAUP 3.1.1 was used to perform the cladistic analysis to study the relationships between the species of the *P. radha* group.

Descriptions were made from numerous specimens from collections. It should be noted that many species when alive or freshly collected will be green rather than ochraceous or brownish.

Measurement were made using a sliding calliper. Most specimens measured were selected at random or all available specimens were measured but sometimes specimens were selected to include extremes of both ends of the range of variation.

#### PHYLOGENY OF THE *P. radha* GROUP

A preliminary phylogenetic analysis was carried out to investigate the relationships within the *P. radha* group. Three outgroups were used for this analysis: two distant relatives, viz. *Meimuna mongolica* (Distant, 1881) and *Platylomia tonkiniana* (Jacobi, 1905), and one closer relative, viz. *Platylomia flavida* (Guérin Méneville, 1834). The characters used are discussed below and the matrix is given in table 1.

1. – Shape of tergite 3: 0, longer laterally than medially; 1, virtually equally long laterally and medially.

In the *P. radha* group and *P. flavida* tergite 3 is virtually equally long laterally and medially, and the anterior margin of tergite 3 is virtually straight. In all other species of the Dundubiaria, except those of the *Dundubia terpsichore* group (see Bloem & Duffels 1976: fig. 1) and *Platylomia larus* (Walker, 1858) from Sri Lanka, tergite 3 is considerably longer laterally than medially and the anterior margin of tergite 3 is distinctly concave.

2. – Posterolateral and posterior spots on pronotal collar: 0, present; 1, absent.

The basic pattern in the Dundubiini consists of several pairs of markings on the pronotal collar, usually an anterolateral pair, a posterolateral pair and a posterior pair. Relative positions and sizes can vary and often all three pairs are present though one may be less distinct. In a number of groups one or more spots are reduced or even absent, for example, in most species of *Dundubia* all spots are absent (see also Overmeer & Duffels 1976, Beuk 1996). The posterolateral and posterior spots are absent only in some

Table 1. Character state matrix for the species of the *P. radha* group and outgroups used in the cladistic analysis.

	1	2	3	4	5
<i>M. mongolica</i>	0	0	0	0	0
<i>P. tonkiniana</i>	0	0	0	0	0
<i>P. flavida</i>	1	1	0	0	0
<i>P. bivocalis</i>	1	1	1	0	0
<i>P. pendleburyi</i>	1	1	1	1	0
<i>P. malickyi</i>	1	1	1	1	0
<i>P. radha</i>	1	1	1	1	1
<i>P. bocki</i>	1	1	1	1	1
<i>P. ficulnea</i>	1	1	1	1	1

groups en several not-closely related species (e.g., *P. amicta* (Distant, 1889) and relatives, *P. radha* group and *Platylomia virescens* Distant, 1905).

3. – Shape of timbal covering: 0, shorter than broad; 1, as long as or longer than broad.

In the Dundubiini the timbal coverings are usually shorter than broad at the base. The timbal coverings are as long as or longer than broad at base in the species of the *P. radha* group and in several other species (e.g., in species of *Aola* Distant, 1905). However, the character of this feature is not identical in the *P. radha* group and the other species. In the species of the *P. radha* group the timbal coverings are elongated and the timbal organs are almost completely covered. In the other species the timbal coverings are narrowed medially and the timbal organs are thus partly exposed.

4. – Central fasciae pronotal disc; 0, wholly or partly developed and black; 1, present as dot on posterior margin of disc or weakly developed and brown.

Similar to the markings on the pronotal collar the basic pattern in the Dundubiini consists of an elaborate pattern of dark markings on the pronotal disc. The pattern of markings usually consists of darkening of the lateral margins, dark fasciae on the oblique fissures and dark central fasciae. In some groups these markings are strongly reduced so that at most the central fasciae are distinct but even these can be wholly or partly absent, e.g., in most species of *Dundubia* (see also Overmeer & Duffels 1976, Beuk 1996).

In some species of the Dundubiini the transverse part of the suture between the pronotal collar and pronotal disc is darkened while the markings on the disc are otherwise mostly reduced. It is possible that the dark dot on the posterior margin of the disc is a remainder of this transverse darkening and not a remainder of the central fasciae. In that case the results of the analysis carried out here do not change because then character state 1 would read 'absent or only weakly developed and brown.'

5. – Shape uncus lobes: 0, gradually narrowing from bases onwards (fig. 37); 1, rather abruptly narrowing near bases (figs. 4, 16).

In the Dundubiaria the shape of the uncus lobes ranges from two more or less flat lobes to a rather complex three-dimensional structure. Irrespective of this shape there usually is a gradual narrowing from near the basal part of the uncus towards the distal margin of the uncus lobes even though the lobes may broaden again distally. In only few species there is a more abrupt narrowing near the basal part of the uncus.

The analysis (exhaustive search) resulted in a single most parsimonious tree (tree length 5; CI = 1.0, RI = 1.0) which is given in fig. 1. The tree given shows the two distant relatives in a basal polytomy.

There are some conclusions that can be drawn from this preliminary analysis. The elongation of the timbal coverings (character 3 state 1) is a synapomorphy for the species of *P. radha* group. Within the *P. radha* group *P. radha*, *P. bocki* and *P. ficulnea* are grouped together on the basis of the more abrupt narrowing of the uncus lobes near their bases (character 5 state 1). These species are indeed very similar as is also clear from the descriptions below. Most characters that can be used to separate these species (markings on tegmina, shape of opercula) do not have much phylogenetic significance (see also Beuk 1996).

The clade with *P. radha* is placed in polytomy with *P. pendleburyi* and *P. malickyi* because they share the (almost) complete reduction of the central fasciae

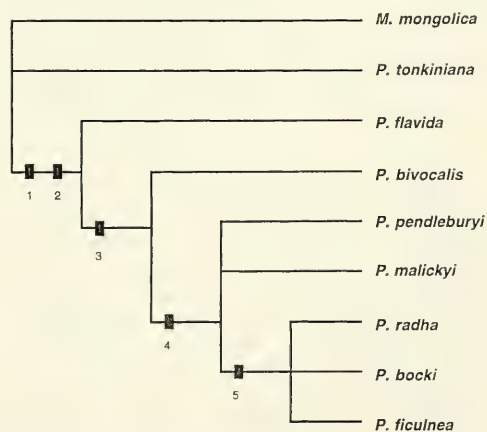


Fig. 1. Cladogram showing relationships between species of *P. radha* group with *M. mongolica*, *P. tonkiniana* and *P. flavida* as outgroup. Synapomorphies (0??1) are indicated; see table 1 for the matrix and text for characters.

(character 4 state 1). Whether this is a good synapomorphy should become clear after further analysis of other groups in the *Dundubiarina* since this character state can also be found in most species of *Dundubia* (see also Beuk 1996).

Only tentative conclusions can be drawn about the phylogenetic position of the *P. radha* group. Within *Platylomia* it appears that *P. flavida* is a close relative since it shares a synapomorphy with the *P. radha* group: the shape of tergite 3 (character 1 state 1). *P. flavida* may constitute the sistergroup of the *P. radha* group. From the analysis it would appear that the absence of the posterolateral and posterior markings on the pronotal collar (character 2 state 1) would also be a synapomorphy for the clade *P. flavida* + *P. radha* group but as remarked above this state also occurs in *Dundubia* and it might indicate a relationship between this clade and *Dundubia*.

#### TAXONOMY

##### *Platylomia* Stål, 1870

*Cosmopsaltria* subg. *Platylomia* Stål, 1870. Type-species (by monotypy): *Cicada flavida* Guérin-Méneville, 1834  
*Platylomia*; Distant (1905) [raised to generic level]

##### The *Platylomia radha* group

##### Diagnosis

Large cicadas: ♂: 40.0-56.5 mm, ♀: 38.0-48.0 mm. Body generally ochraceous brown, head and thorax with some darker markings. Opercula unicolorous brownish, only darkened in lateroproximal corner, male opercula elongate. Dorsal part of abdomen usually darker than head and thorax. Timbal coverings of male elongate, at least as long as broad at base. Pygofer rather narrow; basal part of uncus short, narrower than maximum width uncus, and little globose.

Head. – Postclypeus brown to castaneous, slightly darker dorsally and usually paler on anteromedial spot, little swollen. Anteclypeus brownish, sometimes darkened on lateral surfaces. Vertex brownish, usually darker on vertex lobes and with dark brown to black markings in area of ocelli and often along posterior margin. Rostrum brownish, darkened at tip only; reaching between to distinctly beyond hind coxae but never further than halfway sternite 1.

Thorax. – Pronotum slightly to distinctly broader than head, brown to castaneous but sometimes with greenish tinge. Pronotal disc with dark brown to black pattern ranging from small split medial spot at transverse part of pronotal suture to more elaborate

pattern including central fasciae and transverse bands just posterior of anterior margin and on transverse part of pronotal suture. Pronotal collar broad, median length 0.2-0.3 times the median length of pronotal disc; posterior margin black; lateral part of collar with darker brown to blackish markings that may be connected with transverse band on pronotal suture; anterolateral corner with lateral tooth. Mesonotum ochraceous brown to brown, sometimes with greenish tinge on paler parts, occasionally posterior half partly castaneous; disc with pattern of narrow fasciae consisting at least of paramedian fasciae, lateral fasciae usually absent. Cruciform elevation concolorous with mesonotal disc or slightly paler. Area enclosed by arms of cruciform elevation and parts of mesonotal disc occasionally with waxy coating. Katepimeral lobe usually longer than broad at base.

Tegmina and wings. – Tegmina hyaline to brownish hyaline, always with indistinct brownish reticulation along distal margin and sometimes in apical cells; tegmina either without markings, or with markings on second, third, fifth, and seventh apical cells and at apices of longitudinal veins of apical cells, or intermediate; basal cell partly fumose. Wings hyaline to pale brownish hyaline, infusate along very narrow strip posterior of first anal vein.

Legs. – All legs ochraceous to brownish with varying dark pattern on fore legs, mid tibiae and tarsi, and hind tibiae and tarsi. Fore femur posteroventrally with middle spine shorter than proximal spine; proximal spine slender, middle spine more pointed than proximal spine, often broadened at base and thus more triangular; distal spine short but distinct, either pointed or blunt, sometimes also broadened at base. Hind tibiae with 3-5 anterodorsal spines and 2-6 anteroventral spines, occasionally with single anterior spine.

Male operculum. – Operculum rather variable in length and shape, reaching from anterior margin of fifth to just beyond posterior margin of seventh abdominal segment; ochraceous to brown but sometimes with greenish tinge and sometimes partly covered with waxy coating, some parts near lateroproximal corner dark brown to black. Medial margin weakly convex for short distance proximal of constriction, distal of constriction convex for at least some distance. Apex lateral of midline, rounded or angularly rounded to gully-shaped. Lateral margin convex for short distance proximal of constriction, concave at level of timbal covering, distal of constriction convex but often straight or sometimes even concave on distal third.

Male abdomen. – Abdomen 1.2-1.5 times as long as head and thorax together. Dorsal part of tergites brownish to dark castaneous but usually paler laterally, tergites 3-7 either with or without darker spots



near lateral margin; sternites and ventral parts of tergites paler than dorsal parts but sometimes less so on segments 6-7. Tergites usually with a pattern of waxy coating and/or whitish dusting. Posterior margins of tergites (5) 6-7 with spinules. Sternite 7 with very shallow to rather deep posteromedial emargination. Timbal covering brownish to castaneous but sometimes with greenish tinge, about 1.0-1.3 times as long as wide.

Male genitalia. – Yellowish brown to dark brown. Basal pygofer lobes narrow and ridge-like to broad and rounded. Basal part of uncus little globose, short, and rather narrow. Uncus lobes short and gradually narrowing distally or first narrowing and then somewhat broadening distally; distal margin ranging from smooth and sinuous to adorned with lobule or triangular projections; laterodistal corner produced to varying extend; lateral margin distally sometimes adorned with dorsal (inner) flange or with one or more small triangular projections.

Female operculum. – Operculum greenish to brownish and often darkened lateroproximally; reaching little beyond anterior margin of segment 3, only little curved around abdomen laterally.

Female abdomen. – Abdomen 0.9-1.1 times as long as head and thorax together, castaneous brown

to largely blackish dorsally but paler laterally and ventrally, tergites 3-6 (7) either with or without darker spots near lateral margin. Tergites usually with pattern of waxy coating and/or whitish dusting. Posterior margins of tergites (3) 4-8 with short dark spines but only laterally on tergites (3) 4-5, on tergite 6 either only laterally or along whole length, on tergite 7 along whole length and on tergite 8 only medially. Sternite 7 with angular to angularly rounded posteromedial emargination, sometimes in median lobe.

Female genitalia. – Pygofer brownish to dark castaneous or blackish; distal part of ovipositor sheath dark castaneous to blackish. Dorsal margin of pygofer in lateral view weakly concave and with slight bump at base of caudodorsal beak; ventral margin somewhat stronger convex. Ovipositor sheath short, at most reaching little beyond apex of caudodorsal beak.

#### Key to the males of the *Platylomia radha* group

1. Tegmina with distinct markings on basal veins of second, third, fifth, and seventh apical cells, and at apices of longitudinal veins of apical cells (when in doubt both alternatives can be followed).....2
- Tegmina with indistinct markings only on basal

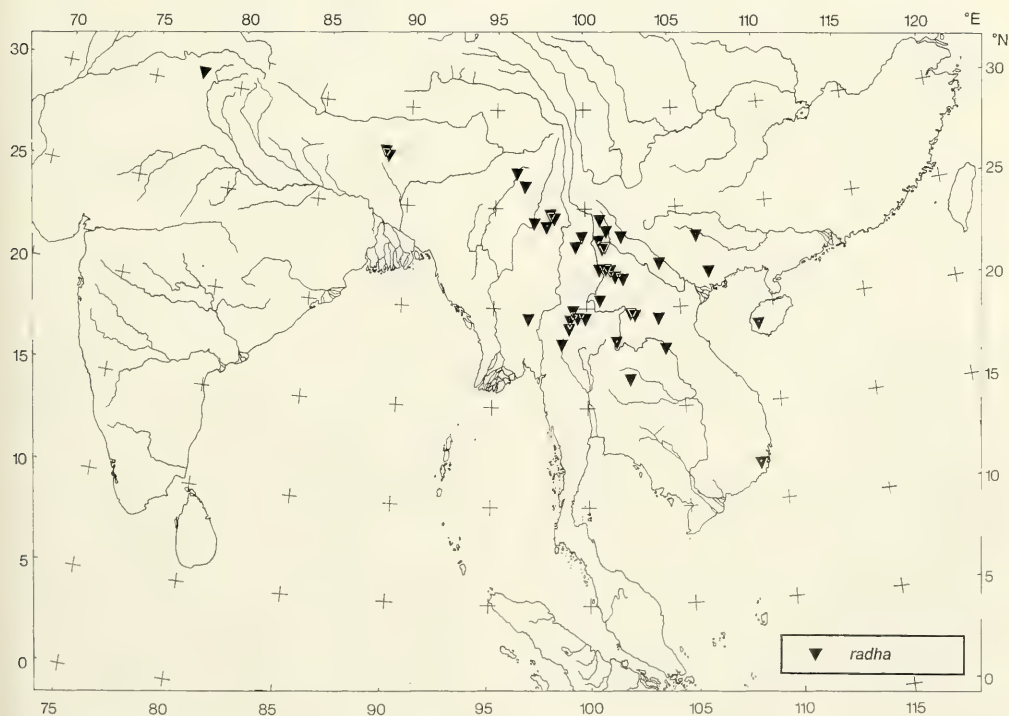


Fig. 2. Localities of *P. radha*.

- veins of second and third apical cells or without markings.....5
2. Tegmina distinctly brownish infusate along veins. Tergites 5 and 6 completely covered with whitish dust obscuring ground-colour of tergites. .... *P. bivocalis*
    - Tegmina at most slightly infusate along veins. Tergites 5 and 6 at least partly without whitish dust .....3
  3. Opercula attenuate at apex and long, reaching to anterior margin of sixth abdominal segment or further (fig. 27)..... *P. ficulnea*
    - Opercula rounded at apex and short, at most reaching to anterior margin of sixth abdominal segment (figs. 20, 34, 49).....4
  4. Distal part of opercula diverging from abdomen, so well visible in dorsal view. Uncus lobes gradually narrowing towards distal margin (fig. 45). Larger species: body length more than 50 mm. .... *P. pendleburyi*
    - Distal part of opercula close to abdomen, if divergent than not broadly rounded at apex. Uncus lobes distally slightly broader than at about halfway from bases (figs. 16, 30). Smaller species: body length less than 50 mm .....6
  5. Apices of opercula variable in shape, distal third of opercula gradually narrowing or attenuate (figs. 11-13); operculum usually reaching further than halfway sixth abdominal segment, if shorter than narrowed towards apex and medial concave area shallow (fig. 11)..... *P. radha*
    - Apices of opercula rounded and at most little narrowed, opercula reaching no further than anterior margin of sixth abdominal segment (figs. 20, 34) .....6
  6. Transverse part of pronotal suture with narrow black band may not be connected to markings on lateral part of pronotal collar. Distal part of operculum broad, narrowing little towards apex (fig. 20). Distal margins of uncus lobes convex near mediodistal corner and concave near laterodistal corner; laterodistal corner angular to slightly pointed (figs. 16, 19). Margins of uncus lobes at most with one or two small wart-like outgrowths (fig. 19)..... *P. bocki*
    - Transverse part of pronotal suture with broad black band that is connected to markings on lateral part of pronotal collar. Distal part of operculum narrowing somewhat towards apex (fig. 34). Distal margin of uncus lobes with medial lobule that carries two small distal projections at its distal margin (figs. 30, 33). Lateral margin near laterodistal corner with several short, pointed projections (figs. 30-31, 33) ..... *P. malickyi*

***Platyloimia radha* (Distant, 1881)**  
(figs. 2, 4-15)

- Dundubia radha* Distant, 1881: 634. – Lectotype ♂ (here designated) of *Dundubia radha* Distant: 'Type' [printed on round label with red margin], 'Masuri / Hills' [handwritten], 'radha / Dist.' [Distant's handwriting], 'Distant Coll. / 1911-383.' [printed].
- Dundubia radha*. – Distant 1882: 160; Atkinson 1884: 225; Atkinson 1886: 163; Distant 1888a: 292; Distant 1888b: 455.
- Dundubia similis* Distant, 1888a: 292. – Lectotype ♂ (here designated) of *Dundubia similis* Distant: 'Type' [printed on round label with red margin], 'Sikkim' [handwritten], 'similis / Dist.' [Distant's handwriting], 'Distant Coll. / 1911-383.' [printed]. **Syn. n.**
- Cosmopsaltria similis*. – Distant 1889: 45; Distant 1890: pl. V figs. 10-10b; Distant 1892b: xii.
- Cosmopsaltria radha*. – Distant 1889: 46, pl. IV figs. 9-9b; Distant 1890: 54; Distant 1892b: xii; Noualhier 1896: 254; Distant 1897: 17; Noualhier & Martin 1904: 179.
- Platyloimia similis*. – Distant 1906a: 102; Distant 1906b: 61; Distant 1912: 49; Paiva 1919: 372; Moulton 1923: 98 [partim, unspotted tegmina], 102-103 [partim; Sikkim, Assam], 167 [partim; Sikkim, Assam]; Kato 1932: 166; Metcalf 1963: 625.
- Platyloimia radha*. – Distant 1906a: 105, fig. 31; Distant 1906b: 61; Distant 1912: 49; Distant 1913: 560; Distant 1917: 101; Kato 1932: 166; Mathur 1953: 140; Metcalf 1963: 623; Hayashi 1978: 177, figs. 20-21; Duffels & Van der Laan 1985: 122; Lei & Li 1994: 92, 94.
- Platyloimia operculata* Distant, 1913: 559. – Lectotype ♂ (here designated) of *Platyloimia operculata* Distant: 'Type / H.T.' [printed in round label with red margin], 'Indo-China. / (R. Vitalis.)' [printed], 'Platyloimia / operculata / type Dist.' [Distant's handwriting], '1913-222.' [printed]. **Syn. n.**
- Platyloimia operculata*. – Distant 1917: 101; Metcalf 1963: 623.
- Not: Moulton 1923: 98 [partim; faint infuscations on tegmina], 100, 102-103 [partim; Thailand], 167 [partim; Thailand] (undescribed species of *Platyloimia*).

*P. radha* is the most widespread species of the *P. radha* group and displays the largest amount of variation in body size, shape of the opercula, and shape of the distal part of the uncus lobes. Specimens with attenuate opercula resemble *P. feae* but can readily be recognised by the absence of distinct markings on the tegmina. Specimens with more rounded opercula mostly resemble *P. bocki*.

*P. radha* appears to be very closely related to *P. bocki*. The main differences can be found in the opercula and the male genitalia. The opercula of *P. radha* are short or long but always narrowed near the apex or even attenuate, whereas those of *P. bocki* are short and broad almost to the apex. The male genitalia differ in the shape of the pygofer and the uncus. The basal pygofer lobes are smaller in *P. radha* and reach not as far posteriorly between the lateral margins of the pygofer as in *P. bocki* (compare figs. 4 and 16). The ventral (outer) surface of the uncus lobes has a

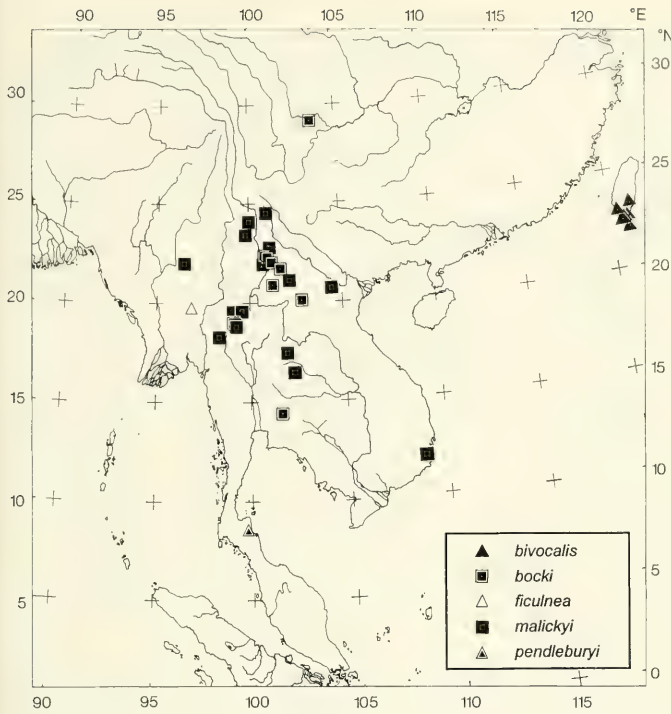


Fig. 3.  
Localities of *P. bivocalis*, *P. bocki*, *P. ficulnea*, *P. malickyi*  
and *P. pendleburyi*.

ridge running roughly from the mediobasal corners to the medial part of the basal part of the uncus. In *P. radha* this ridge is much lower and smoother than in *P. bocki*. The uncus lobes of *P. radha* have a distinct flange of variable shape on the lateral margin, whereas in *P. bocki* the lateral margins are smooth or (occasionally) provided with one or two small wart-like outgrowths. *P. bocki* is generally smaller than *P. radha*, the largest specimens of *P. bocki* being about the same size as the smallest specimens of *P. radha*.

### Description

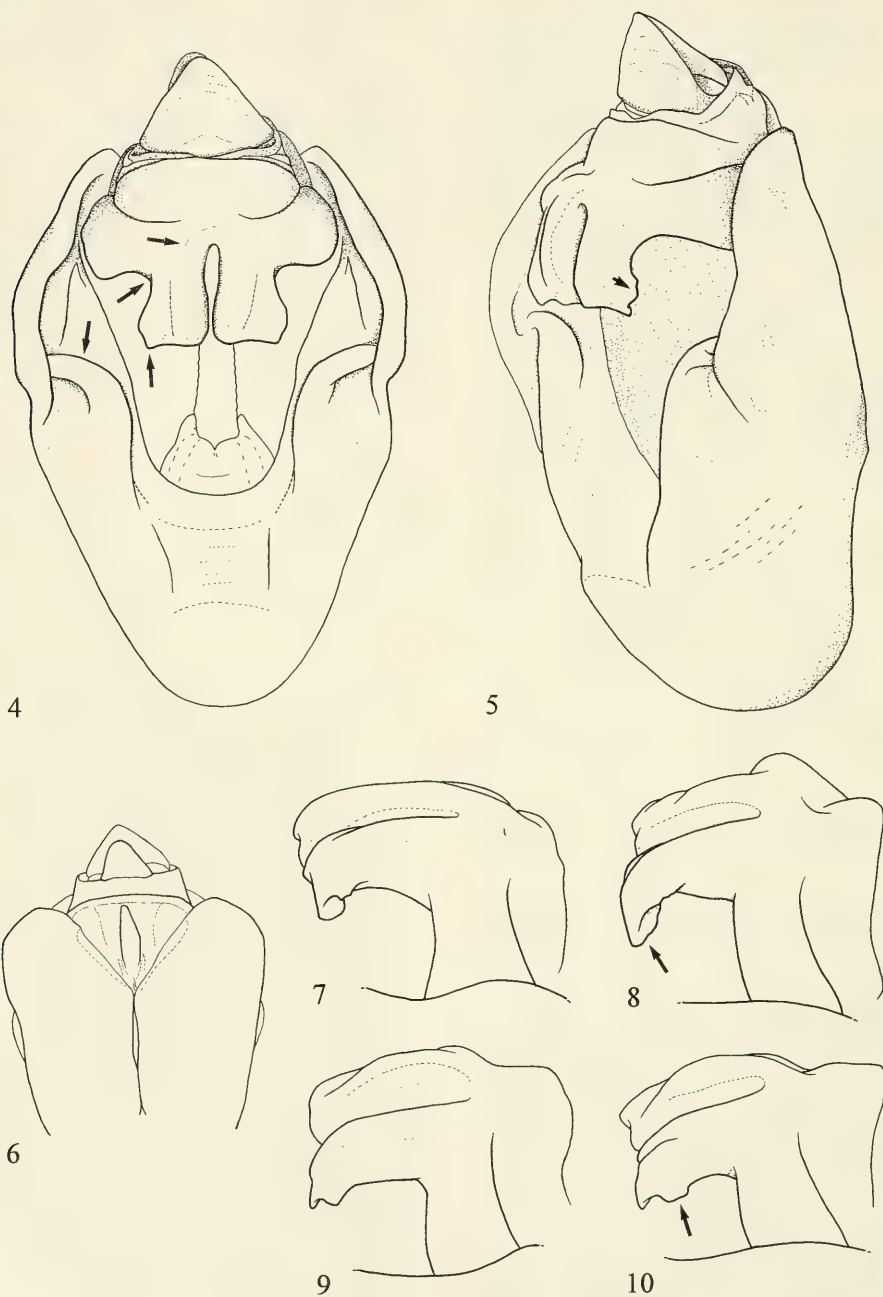
Body brownish to castaneous, often with some parts of head and thorax lighter, mesonotum with median and paramedian fasciae partly developed, tegmina without markings but basal veins of second and third apical cells occasionally almost imperceptibly infuscated. Opercula very variable in shape, ranging from relatively short and almost rounded at apex to long and almost gully-shaped at apex.

Head. — Postclypeus brown to light castaneous, sometimes paler on area anterior of frontoclypeal suture and ventrally along lateral margin and at clypeal suture; little swollen, in dorsal view about as long as distance between frontoclypeal suture and anterior margin of pronotum. Anteclypeus brownish. Vertex brownish but somewhat darker on lateral part and on supra-antennal plates; posterior margin with pair of

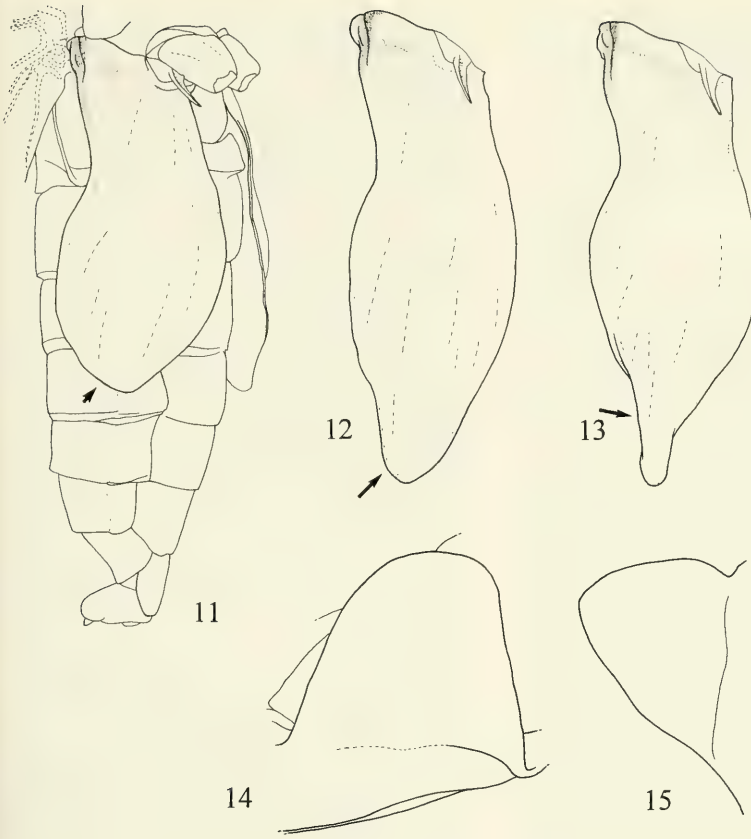
black spots close to eyes; part posterior of eyes with black marking, either rounded or extending to and along posterior margin of eye; area of ocelli with darker brown to black marking that encloses anterior ocellus and reaches laterally as far as lateral ocelli. Genae ochraceous, lori darkened along suture with clypeus. Frontoclypeal suture semicircular but median part almost straight, much broader than distance between lateral margins of lateral ocelli. Rostrum brownish, darkened at tip only; reaching halfway between hind coxae to posterior margin of hind coxae.

Thorax. — Pronotum slightly to distinctly broader than head. Pronotal disc brownish, anterior margin and often medial area paler; disc immediately posterior of anterior margin with dark brown to black transverse band that is usually broadly interrupted medially; central fasciae usually not developed except for two brownish triangular markings with their base at pronotal suture; transverse part of pronotal suture with dark brown to black band that is broadest medially and continues laterally to level of markings on lateral part of pronotal collar. Pronotal collar usually paler than pronotal disc and with black posterior margin that broadens slightly in posterolateral corners; anterolateral part of collar with darker marking between lateral margin and pronotal suture, marking darkest at suture and often connected with band on transverse part of pronotal suture; anterolateral cor-





Figs. 4-10. *Platylomia radha* (Distant, 1881), male. — 4, pygofer and uncus in ventral view, Jingkawsakan; 5, pygofer and uncus in right lateroventral view, Jingkawsakan; 6, pygofer in dorsal view, Doi Inthanon; 7, uncus in right lateroventral view, Doi Inthanon; 8, uncus in right lateroventral view, Tonkin; 9, uncus in right lateroventral view, Ceylan; 10, uncus in right lateroventral view, lectotype *P. radha*.



Figs. 11-15.

*Platylomia radha* (Distant, 1881), male. — 11, abdomen and right operculum in lateroventral view, lectotype *P. similis*; 12, right operculum in lateroventral view, lectotype *P. operculata*; 13, right operculum in lateroventral view, lectotype *P. radha*; 14, right timbal covering, lectotype *P. radha*; 15, right katepimeral lobe, Jingkawksakan

ner with small but distinct lateral tooth; posterolateral corner rounded but sometimes part of margin only weakly convex. Mesonotum ochraceous brown to brown, sometimes even castaneous; median fascia variable, from almost indistinguishable to blackish; paramedian fasciae on anterior half of disc black, narrow near anterior margin of disc then broadening and slightly curved medially, on posterior half usually present as distinct black or indistinct brownish markings of varying size in front of cruciform elevation; anterior margin of disc with dark brown to blackish triangular markings immediately lateral of mesonotal fissures; lateral fasciae absent. Cruciform elevation ochraceous brown to dark brown, concolorous with or paler than mesonotal disc. Katepimeral lobe (fig. 15) shorter than broad at base, apex rounded. Surface of katepimeral lobe concave along dorsal margin, dorsal margin thus curved outwards; surface covered with short, waxy hairs. Apex of katepimeral lobe reaching over base of operculum but sometimes only just.

Tegmina and wings. — Tegmina almost entirely hyaline with indistinct brownish reticulation along

distal margin and sometimes in apical cells; basal veins of second and third apical cells rarely with almost indistinguishable infuscation; basal cell yellowish fumose on anterior half. Veins of tegmen brownish, darker on most cross veins and parts where veins meet or split. Wings hyaline. Veins of wings brownish, medial vein and veins close to wing margin darker.

Legs. — Legs ochraceous to brownish. Fore femora ochraceous, posteroventrally with darkened longitudinal stripe; tibiae slightly darker than femora except on dorsal surface; tarsi brownish. Mid femora ochraceous; tibiae brownish, slightly darker at base and on apical third, especially ventrally; tarsi brown. Hind femora ochraceous, slightly darkened anteriorly; tibiae often little darker than femora, dark brown at joints with femora; tarsi brownish. Fore femur with gap between middle and distal posteroventral spines shallow and broad. Hind tibia with two dorsal spines and usually four but occasionally only three anteroventral spines; spines brownish.

Male operculum (figs. 11-13). — Operculum rather variable in length and shape, reaching about halfway

fifth abdominal segment to just beyond posterior margin of seventh abdominal segment, 2.2-3.0 times as long as maximum width distal of constriction; ochraceous to brown and frequently some parts covered with waxy coating, area of lateroproximal corner and usually also part of lateral margin dark brown to black but with ochraceous spot on margin just distal of lateroproximal corner. Medial margin distal of constriction convex to apex but near apex often less convex or almost straight, margin on distal third frequently appearing concave because surface becomes weakly concave along margin. Apex of operculum lateral of midline and variable in shape: either apex rounded to angularly rounded with operculum gradually narrowing distally (fig. 11), or angular with surface concave along one margin only (usually lateral margin), or gully-shaped with surface concave along both medial and lateral margin (fig. 13) and then often divergent from abdomen. Lateral margin distal of constriction convex but often less convex or almost straight near apex, margin on distal third frequently appearing concave because surface becomes weakly concave along margin. Constriction at about 0.3 of length of operculum, lateral concavity longer and deeper than medial concavity and at deepest point often almost angular, broadest part of operculum distal of constriction 1.3-1.5 times as wide as minimum width in constriction. Distance between opercula at constrictions about 0.8-1.1 times as wide as minimum width in constriction. Opercula at point of closest approximation separated for a distance of 0.5-0.7 times maximum width between opercula at constrictions. Operculum close to abdomen but distal half well removed from abdomen when apex gully-shaped; surface only weakly convex in longitudinal direction or concave along margins on distal third, surface more strongly convex in transverse direction, especially on distal third.

Male abdomen. – Abdomen about 1.3-1.5 times as long as head and thorax together. Dorsal part of tergites brownish to castaneous, often somewhat darkened along posterior margins; sternites and ventral parts of tergites paler than dorsal parts but less so towards genitalia. Tergite 1 laterally and tergite 2 paramedially usually with white waxy coating, tergite 3 with dense whitish dust closer to lateral margin, tergite 4 usually with smaller area of whitish dusting at posterior margin, some dusting present on tergites 5-7 but without distinct pattern, tergite 8 completely covered with whitish dust. Posterior margin of tergite 7 with many short dark spinules, of tergite 6 and occasionally also of tergite 5 with few spinules on lateral part. Sternite 7 with shallow to very shallow posteromedial emargination. Timbal covering (fig. 14) brownish to castaneous, about 1.0-1.1 times as long as wide; medial margin virtually straight, convergent

with lateral margin; mediiodistal corner, distal margin and laterodistal corner rounded; lateral margin almost straight.

Male genitalia (figs. 4-10). – Brown; dorsal part of pygofer somewhat darker than ventral part; uncus lobes usually darker along lateral and distal margin. Basal pygofer lobes broad and rounded (figs. 4-5); hairs on anteroventral margin of pygofer erect, not very long and continuing on pygofer surface enclosed by anteroventral margin, hairs shorter on apices of basal lobes, towards medial part of anteroventral margin and on surface enclosed by anteroventral margin; pygofer surface anterior of medial part of anteroventral margin and lateral of anteroventral margin with scattered hairs, dorsolateral surface covered with many short hairs. Dorsal part of pygofer as in fig. 6. Basal part of uncus small, little globose and narrower than maximum width uncus (figs. 4-5); near bases of uncus lobes usually with some thick erect hairs and several thinner hairs more medially, occasionally only very few hairs present. Uncus lobes (figs. 4-5, 7-10) short; medial margin weakly concave and curved dorsad (inwards) along whole length; mediiodistal corner rounded and also slightly curved dorsad (inwards); distal margin weakly concave; laterodistal corner (figs. 7-10) produced and pointed to varying extent, tip directed anterodorsad (inwards) to laterad; lateral margin strongly curved medially close to base, distal part of uncus lobe then gradually broadening towards distal margin or narrow for some distance and broadening more abruptly near distal margin; lateral margin near laterodistal corner with flange of irregular shape. Ventral (outer) surface of uncus lobes with longitudinal grooves near anterior margin and each uncus lobe with indistinct ridge from mediiodistal corner almost to basal part of uncus where ridges nearly meet. Bases of uncus lobes laterally usually with numerous strong erect hairs both on dorsal (inner) and ventral (outer) surfaces, those on dorsal surface shorter except for occasional very long hairs.

Female operculum. – Operculum brownish, darker basally and along medial margin, lateral margin castaneous. Lateral margin distal of lateroproximal lobe weakly convex to weakly concave; laterodistal corner angularly rounded; distal margin weakly convex but often concave for very short distance near laterodistal corner; mediiodistal corner broadly rounded; medial margin short and convex; lateral and medial margin of each operculum virtually parallel.

Female abdomen. – Abdomen about as long as head and thorax together. Dorsal part of tergites castaneous brown but tergites 1-3 little paler, posterior margins of tergites darkened, tergites without darker spots near lateral margins; sternites and ventral parts of tergites paler than dorsal parts. Tergite 2 and anterior margin of tergite 3 with white dusting laterally



but dusting often rubbed off, dusting on other tergites without distinct pattern. Posterior margins of tergites 4-5 with some short dark spines laterally, of tergite 6 with spines along whole length except medially, of tergite 7 with spines along whole length, of tergite 8 with scattered spines medially. Sternite 7 with angular to angularly rounded posteromedial emargination.

Female genitalia. – Dorsal part of pygofer almost castaneous, remainder brownish; distal part of ovipositor sheath castaneous. Dorsal margin of pygofer shorter than three preceding segments, in lateral view weakly concave; ventral margin weakly convex. Ovipositor sheath reaching almost as far as or short distance beyond apex of caudodorsal beak; anal valve not reaching as far as caudodorsal beak.

Measurements in mm (♀: n = 6). – Body length: ♂: 44.5-56.5 ( $51.5 \pm 3.1$ ) (n = 12), ♀: 38.5-44.5 ( $40.9 \pm 1.4$ ); head width: ♂: 12.6-15.3 ( $14.2 \pm 0.7$ ) (n = 12), ♀: 13.3-15.0 ( $14.0 \pm 0.6$ ); maximum pronotum width: ♂: 12.8-16.8 ( $15.3 \pm 0.8$ ) (n = 11), ♀: 14.7-16.3 ( $15.2 \pm 0.5$ ); tegmen length: ♂: 44.5-62.5 ( $56.6 \pm 3.0$ ) (n = 12), ♀: 53.3-61.5 ( $57.0 \pm 2.7$ ).

### Variation

*P. radha* shows considerable variation in several characters but there seems to be hardly any geographic pattern. The characters showing variation are body colour, body length, length of operculum, shape of apex of operculum, and shape of laterodistal corner of uncus lobe. The general pattern is that smaller specimens with shorter opercula and opercula with more rounded apices (fig. 11) tend to come from the north-western part of the range of *P. radha*. However, larger specimens with longer, attenuate opercula (as in fig. 13) have also been found in that part of the range (see Hayashi 1978: fig. 20). Smaller specimens are also found in the central part of the range and specimens with more angularly rounded opercula (compare fig. 12) are found in the eastern part of the range.

Variations in shape of laterodistal corner of uncus lobe (figs. 7-10) and variations in colour show no geographic pattern at all. Differences in colour are probably due to different circumstances in killing and preserving specimens.

### Distribution (fig. 2)

*P. radha* has a wide distribution and is recorded from southern parts of the Himalaya (Bhutan; India: Assam, Sikkim; Nepal) through Indo-China (Burma, Cambodia, Laos, Thailand, Vietnam) to southern China in the east (Hainan, Sichuan, Yunnan). A number of records in the literature are doubtful. The record from Madras (Distant 1881, 1890, 1906a; Atkinson 1884) could not be confirmed and may have

been caused by wrong location of the type locality in the Madras Presidency. Since the nearest locality is more than 1,500 km away the accuracy of this old record is questioned. Moulton's (1923) record of *P. similis* from Khao Luang, just south of the Kra Isthmus on the Malay Peninsula refers to a yet undescribed species of *Platylomia*.

### Synonymy

Examination of the lectotypes of *P. radha* and *P. similis* has shown that they differ in several aspects. The lectotype of *P. similis* is smaller and paler than the lectotype of *P. radha*, its opercula are shorter and not attenuate, its timbal covering is more triangular, and the shape of the distal margin and laterodistal corner of the uncus lobes is different. The lectotypes of *P. radha* and *P. operculata* are more resemblant. The lectotype of *P. operculata* is a little larger and darker than lectotype of *P. radha*, its opercula are a little longer and the apices of the opercula are narrowed and not attenuate. The lectotype of *P. operculata* is damaged by museum beetle and its genitalia are partly destroyed. The remains of the genitalia are identical to those of the lectotype of *P. radha*.

Examination of further collection material under *P. radha*, *P. similis* and *P. operculata* has shown that several characters show variation. The characters given by Distant (1888a, 1913) to distinguish *P. similis* and *P. operculata* from *P. radha* (colour, shape of operculum) are two of these characters (see discussion of variation above). The three species in fact represent different forms of the same species. Since there are no characters that seem to justify a separation of *P. similis* and *P. operculata* from *P. radha*, *P. similis* and *P. operculata* are herewith synonymised with *P. radha*.

### Remarks

In the descriptions of *Dundubia radha*, *D. similis* and *P. operculata* neither holotypes were designated nor were the numbers of specimens upon which the descriptions were based mentioned. No lectotype designations were published subsequently. For this reason the presence of labels on specimens indicating type status cannot be considered valid type designations. For each of the three species it applies that specimens belonging to the type series should be considered syntypes and lectotypes have to be designated (ICZN Recommendation 73F).

The type material of *P. radha* was stated to originate from 'Madras Presidency; Masuri [Mussoorie] Hills' in India (Distant 1881: 684) but it is not clear whether Distant referred to two localities or to one locality (wrongly locating the Mussoorie Hills in the Madras Presidency). Since later publications (Distant 1889; 1906a) only refer to a specimen from the Madras Presidency in Distant's collection, the latter

may have been the case (see also under Distribution). No specimen from the Madras Presidency could be found so the specimen from Mussoorie is designated as the lectotype.

*P. similis* was described from 'Sikkim' on the basis of material in Distant's collection. There are several males from Sikkim at the BMNH but only one male is from Distant's collection and corresponds with the size mentioned for *P. similis* in the original description. This male is designated as the lectotype.

*P. operculata* was described from 'Indo-China'. Only one male in the BMNH that may have belonged to the type series is available. This specimen is designated as the lectotype.

Material examined. — CHINA: Cangyuan [Mengdong], Yunnan, 1278 m, 12.v.1980, 2 ♂ (NWAS); Cheli [Yunjinghong], Yunnan, 620 m, 4.v.1957, 1 ♂ (IZAS); Jianfeng Ling, Hainan, 13.iv.1982, Gu Maobing, 2 ♂, 1 ♀ (IZAS); Jingdong [Jinping], Yunnan, 1170 m, 21.v.1956, 2 ♂ (IZAS); Jinggu [Weiyuan], Yunnan, 1000 m, 16.v.1956, 1 ♂, 1 ♀ (IZAS); Jinghong [Yunjinghong], Yunnan, 3.iv.1991, 1 ♀ (NWAS); Longlin, Guangxi, 14.vi.1981, 1 ♂ (NWAS); Mangshi, Yunnan, 900 m, 15.v.1955, 4 ♂ (IZAS); Menghai [Xiangshan], Yunnan, 27.iv.1980, 1 ♂ (NWAS); Mengla, Yunnan, 9.v.1991, Wang Yenglun, 1 ♂ (NWAS); Menglun, Yiwubanna, Yunnan, 650 m, 1.v.1964, 2 ♂ (IZAS); Mengyang, Yunnan, 1800 m, 5.vi.1991, 1 ♂ (NWAS); Pu'er [Ning'er], Yunnan, 13.v.1956, 1 ♂ (IZAS); Ruili [Mengmao], Yunnan, 1350 m, 12.vi.1956, 1 ♀ (IZAS); Shuangjiang [Mengmeng], Yunnan, 888 m, 31.v.1980, 1 ♂ (NWAS); Simao, Yunnan, 1200 m, 11.v.1957, 1 ♂ (IZAS); Taiping Shan, Hainan, 5.v.1986, Y. Okuma, 1 ♂ (SUU); Xiaomengyang, Yunnan, 850 m, 4.v.1957, 3 ♂ (IZAS); Yaoqu, Yunnan, 1600 m, 4.v.1991, 1 ♂ (NWAS); Yingjiang [Pingyuan], Yunnan, 22.v.1983, 1 ♂ (NWAS); Yuanjiang [Lijiang], Yunnan, 550 m, 3.v.1980, 1 ♂ (NWAS); Yunnan, 7.v.1957, 1 ♂ (SUU); Zhenyuan, Yunnan, 4.v.1956, 1 ♂ (IZAS); VIETNAM: Chapa [Cha Pai], Tonkin, Indo-China, v. R.V. de Salvaza, 1 ♀ (BMNH); 6 km S. of Dalat [Da Lat], 1400-1500 m, 9.vi-7.vii.1961, N.R. Spencer, 1 ♂, 3 ♀ (BPBM); Mt Tam Dao, N. Vietnam, 1300 m, 10.vii-2.viii.1990, S. Nagai, 1 ♂, 2 ♀ (SUU); Tam Dao, N. Vietnam, 27.vii-2.viii.1992, N. Ohbayashi, 1 ♀ (SUU); Tam Dao, 100 km N.W. from Hanoi, N. Vietnam, 16-27.v.1991, M. Takakuwa, 1 ♂ (SUU); Tonkin, 1 ♂ (MNHN); Tonkin, vi.1917, R.V. de Salvaza, 2 ♂, 1 ♀ (BMNH); CAMBODIA: Cambodge, 1886, A. Pavie, 1 ♂ (MNHN); LAOS: Luang Prabang [Louangphrabang], vi.1916, R.V. de Salvaza, 1 ♂ (BMNH); Muong You [Muang You], Luang Prabang [Louangphrabang], 25.v.1919, R.V. de Salvaza, 1 ♀ (BMNH); Pakkading, Borikhana Province, 22.iii.1965, native collector, 1 ♂ (BPBM); Paklay [Muang Pak-Lay], viii.1917, R.V. de Salvaza, 1 ♂ (BMNH); Phon Saly [Phongsali], N. Laos, 2.v.1994, Y. Miyake, 2 ♂ (SUU); Xieng Khouang [Xiangkhoang], 2.iv.1919, R.V. de Salvaza, 1 ♂ (BMNH); same data, 13.iv.1919, 1 ♂ (BMNH); same data, 15.iv.1919, 7 ♂ (BMNH); same data, 17.iv.1919, 1 ♂, 1 ♀ (BMNH); same data, 22.iv.1919, 1 ♀ (BMNH); same data, 5.v.1919, 1 ♀ (BMNH); THAILAND: Bang Khun Klang, Doi Inthanon, 18°32'N 98°32'E, 1200 m, 10-17.iv.1989, Chantaramongkol & Malicky, light trap, 1 ♂ (IZUI); same

data, 17-24.iv.1989, 1 ♂, 1 ♀ (IZUI); same data, 27.iv-1.v.1989, 6 ♂ (IZUI); Bangkok à Xieng Mai [Chiang Mai], 1887, Pavie, 1 ♂ (MNHN); Changmai [Chiang Mai] Zoo, 18°49'N 98°57'E, 400 m, 24.iv-1.v.1989, Chantaramongkol & Malicky, light trap, 1 ♂ (IZUI); Chiang Dao, Chiang Mai, 1 ♂ (SUU); Doi Chang, N. Siam, 4500 ft, 14.iv.1921, E.J. Godfrey, 5 ♂ (BMNH); Doi Chiang Khian, Chiang Mai, ca. 1250 m, 29.v.1983, H. Kuroko, S. Moriuti, Y. Arita & Y. Yoshiyasu, 1 ♀ (OPU); Doi Inthanon, 1750 m, 25.vi.1987, M.G. Allen, 1 ♂ (BMNH); Doi Inthanon, 2000 m, 13.iv.1988, T.W. Harman, 2 ♂ (ZMAN); Doi Nya Chang, Khun Thal, N. Siam, 15.iv.1941, A.M. Hemmingsen, 1 ♂ (UZMK); Doi Suthep, Chiang Mai, 1.v.1984, T. Endo, light trap, 1 ♂ (SUU); Doi Suthep, N. Thailand, 10.iv.1983, T. Shiromura, 1 ♂ (NSMT); Fang, Chiang Mai, ca. 450 m, 15.v.1983, Kuroko, Moriuti, Arita & Yoshiyasu, 1 ♂ (OPU); Fang, Chiangmai [Chiang Mai] Province, 14.iv.1958, T.C. Maa, 1 ♂ (BPBM); Fang, Chiangmai [Chiang Mai], 500 m, 12-19.iv.1958, T.C. Maa, 2 ♂ (BPBM); same data, at light, 12.iv.1958, 1 ♂ (BPBM); same data, at light, 15.iv.1958, 2 ♂ (BPBM); same data, at light, 19.iv.1958, 3 ♂ (BPBM); Mount Angka [Doi Inthanon], Asiatic Primate Expedition, 1 ♂ (MCZ); Phu Khiao, Chaiyapumh [Chaiyaphum] District, 800 m, 2-4.v.1986, M.G. Allen, 3 ♂ (BMNH); Wiang Pa Pao, Chiang Mai, N. Thailand, 30.iii.1990, 1 ♂, 1 ♀ (SUU); BURMA: Ghecu, Carin, 1300-1400 m, iv.1888, L. Fea, 2 ♂ (MSNG); Jingkawksakan [Tingkawk Sakan], 17.v.1944, L.C. Kuitert, 2 ♂ (SEMCK); Shingbuiyang, 1.v.1944, L.C. Kuitert, 2 ♂ (SEMCK); same data, 13.v.1944, 1 ♂ (SEMCK); same data, J.D. Hitchcock, 1 ♂ (SEMCK); North Chin Hills, Watoon, 1 ♂ (BMNH); southern Shan States, Bingham, 1 ♂ (BMNH); Teinzo, v.1886, L. Fea, 2 ♂ (MSNG); Tingkaw [Tingkawk Sakan], 25.v.1944, L.C. Kuitert, 3 ♂, 1 ♀ (SEMCK); same data, 29.v.1944, 1 ♂ (SEMCK); Upper Burma, 1 ♂ (BMNH); INDIA: Assam, 1 ♀ (BMNH); Masuri [Mussoorie] Hills, ♂ lectotype *Dundubia radha* Distant (BMNH); Naga Hills, Doherty, 1 ♂ (BMNH); Sikkim, ♂ lectotype *Dundubia similis* Distant (BMNH); Sikkim, 3 ♂, 6 ♀ (BMNH); Sikkim, 1 ♂ (NHMS); Sikkim, 1 ♀ (ISNB); Tumlong, Sikkim, Gallasch, 1 ♂ (ZEMK); BHUTAN: Bhoutan Anglais, 1900, R. Oberthur, 1 ♀ (MNHN); Bhoutan, Maria Basti, 1898, Durel, R. Oberthur, 1 ♂ (MNHN); EXACT LOCATION UNKNOWN: no locality given, 4 ♂, 1 ♀ (BMNH); no locality given, 2 ♂ (MSNG); no locality given, 1 ♂ (USNM); Ceylan [Sri Lanka?], Oberthur, 101-96, 1 ♂ (MNHN); Indo-China, R. Vitalis, 1 ♂ lectotype *Platylomia operculata* Distant (BMNH).

Females probably belonging here. — Laos: Vien Poucha [Viangphoukha], Haut Mékong, 3.v.1918, R.V. de Salvaza, 2 ♀ (BMNH); Thailand: Doi Pui, Chiang Mai, ca. 1300 m, 30.v.1983, Kuroko, Moriuti, Arita & Yoshiyasu, 1 ♀ (OPU); Phuping Palace [Phuphing Palace], Chang Mai, 30.iv.1984, T. Endo, 1 ♀ (SUU).

***Platylomia bocki*** (Distant, 1882)  
(figs. 3, 16-22)

*Dundubia bocki* Distant, 1882: 159. – Lectotype ♂ (here designated) of *Dundubia bocki* Distant: 'Type / H.T.' [printed in round label with red margin], 'Indo-China. / (R. Vitalis.)' [printed], 'Platylomia / operculata / type Dist.' [Distant's handwriting], '1913-222.' [printed].  
*Cosmopsaltria bocki*. – Distant 1889: 45, pl. IV figs. 11-11b; Distant 1892b: xii.

*Platylomia bocki*. – Distant 1906b: 60; Distant 1912: 48; Moulton 1923: 98; Kato 1932: 166; Metcalf 1963: 615.

Although *P. bocki* was described in a paper on Sumatran cicadas and the type locality is stated to be Sumatra (Distant 1882), Moulton (1923) already pointed out that this specimen could have come from either Sumatra or Siam (Thailand). Considering that the other specimens of *P. bocki* are all from continental Southeast Asia and the fact that no other species of the *P. radha* group was ever found on Sumatra it seems most likely that the specimen was collected in Thailand. *P. bocki* is a typical species of the *P. radha* group and very closely related to *P. radha*. The main differences are discussed under *P. radha*.

### Description

Body brownish with some parts on head and thorax lighter, mesonotum with median and paramedian fasciae partly developed, the tegmina without markings except for the often infuscated basal veins of second and third apical cells. Opercula relatively short and broad at apex, apical margin either broadly rounded or even partly straight.

Head. – Very much resembling *P. radha*. Vertex as in *P. radha* but marking on area of ocelli always distinctly black; part posterior of eyes without black marking.

Thorax. – Pronotum as in *P. radha*, but general pattern of paler and darker brown parts more distinct; central fasciae usually not developed. Lateral part of pronotal collar with darker brown marking between lateral margin and pronotal suture, marking darkest at suture and often connected with transverse band on pronotal suture, anterolateral corner not darkened; anterolateral corner occasionally bidentate. Mesonotum ochraceous brown to brown; median fascia narrow, broadest on posterior half of mesonotum, usually black and distinct but sometimes brown and rather indistinct; paramedian fasciae on anterior half of disc as in *P. radha*, on posterior half of disc present as black markings of varying size anterior of cruciform elevation; mesonotal fissures ochraceous brown; narrow black triangular markings immediately lateral of mesonotal fissures at anterior margin of disc always distinct and small; lateral fasciae absent; posterior margin with black spots lateral of anterior arms of cruciform elevation that occasionally merge with markings anterior of cruciform elevation. Cruciform

elevation ochraceous to brown, paler than mesonotal disc. Posterior margin and median depressions of cruciform elevation often with dense whitish coating. Katepimeral lobe (fig. 22) mostly as in *P. radha*, apex reaching over base of operculum.

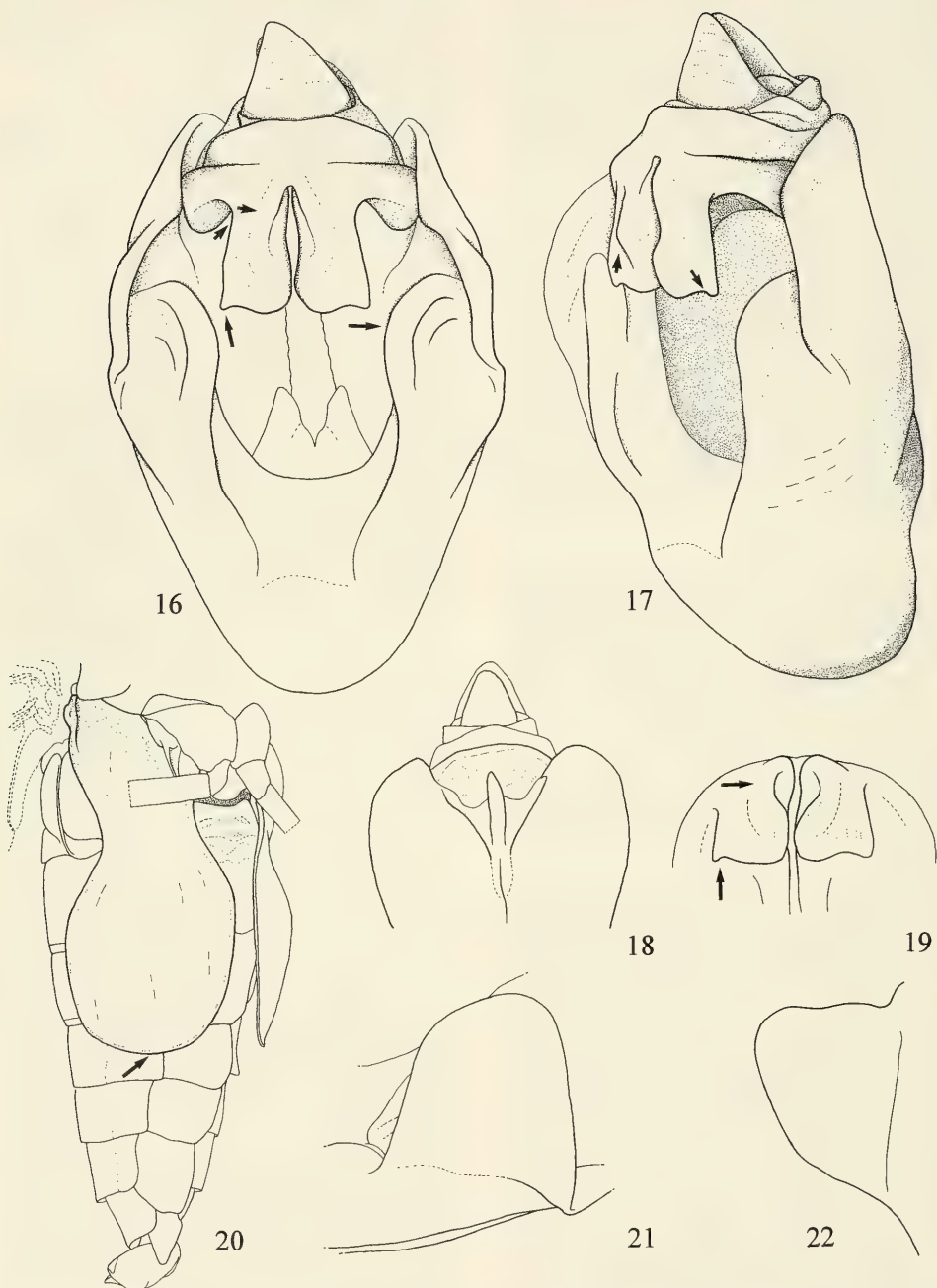
Tegmina and wings. – Tegmina and wings mainly as in *P. radha*. Infuscations on basal veins of second and third apical cells of tegmina usually quite distinct though not very dark, usually more distinct on basal vein of third apical cell. Apices of longitudinal veins of apical cells occasionally with almost indistinguishable spots.

Legs. – Fore legs ochraceous to brownish; femora ochraceous, anterodorsally, posterodorsally and posteroventrally with darkened longitudinal stripes that usually are connected by dark apical ring; tibiae brownish, dorsal surface with ochraceous stripe from base almost to apex; tarsi brownish. Mid legs brownish; tibiae with dorsal surface and apical quarter darkened; tarsi dark brown. Hind legs ochraceous; tibiae slightly to distinctly darkened dorsally at base and on apical fourth; tarsi ochraceous to brown. Fore femur with gap between middle and posteroventral distal spines rounded and not very narrow. Hind tibia sometimes with only two anteroventral spines.

Male operculum (fig. 20). – Not very long, reaching from about anterior margin of fifth to anterior margin of sixth abdominal segment, 2.1-2.2 times as long as maximum width distal of constriction; ochraceous to brown, sometimes with greenish tinge, area around lateroproximal corner and usually also part of the lateral margin dark brown to black but lateroproximal corner itself ochraceous. Medial margin distal of constriction convex but occasionally for some distance in distal half almost straight. Distal margin convex, sometimes straightening medially, usually no distinct apex present. Lateral margin distal of constriction convex to apex but occasionally almost straight about halfway. Constriction at about 0.4 of length of operculum, lateral concavity longer and deeper than medial concavity and at deepest point almost angular, broadest part of operculum distal of constriction 1.5-1.7 times as wide as minimum width in constriction. Distance between opercula at constrictions about 1.2-1.4 times as wide as minimum width in constriction. Opercula at point of closest approximation separated for a distance of 0.3-0.4 times maximum width between opercula at constrictions. Operculum close to abdomen, surface of operculum both proximal and distal of constriction convex thus creating impression of transverse fold at level of constriction.

Male abdomen. – Abdomen as in *P. radha* but slightly paler, about 1.2-1.3 times as long as head and thorax together. Dorsal part of tergites brownish to castaneous, tergites often somewhat darkened along





Figs. 16-22. *Platylomia bocki* (Distant, 1882), male. – 16, pygofer and uncus in ventral view, lectotype; 17, pygofer and uncus in right lateroventral view, lectotype; 18, pygofer in dorsal view, Vieng Vai; 19, uncus in anterior view, lectotype; 20, abdomen and right operculum in lateroventral view, Khao Yai; 21, right timbal covering, Khao Yai; 22, right katepimeral lobe, Khao Yai.

posterior margins; sternites and ventral parts of tergites paler than dorsal parts but less so towards genitalia. Tergite 2 with small paramedian areas of whitish dusting on posterior margin, tergites 3-4 with small lateral areas of whitish dusting on anterior margin, tergite 8 with thin whitish dusting, dusting on other tergites without distinct pattern. Posterior margin of tergite 7 with many short dark spinules, of tergite 6 and occasionally also of tergite 5 with few spinules on lateral part. Sternite 7 with shallow posteromedial emargination. Timbal covering (fig. 21) as in *P. radha*, ochraceous to ochraceous brown, about 1.1-1.3 times as long as wide; lateral margin almost straight to weakly convex.

Male genitalia (figs. 16-19). – Brown, dorsal part of pygofer somewhat darker than ventral part; uncus lobes usually darker than remainder of uncus. Basal pygofer lobes (figs. 16-17) almost as in *P. radha* but reaching further between lateral margins of pygofer; hairs on anteroventral margin of pygofer mostly short and erect but interspersed with longer hairs, hairs decreasing in length towards basal lobes and continuing on pygofer surface enclosed by anteroventral margin; pygofer surface anterior and lateral of anteroventral margin with scattered hairs. Dorsal part of pygofer as in fig. 18. Basal part of uncus small, little globose and narrow (figs. 16-17), near bases of uncus lobes with occasional short erect hairs. Uncus lobes (figs. 16-17, 19) with medial margin weakly concave; mediiodistal corner rounded; distal margin convex near mediiodistal corner, concave near laterodistal corner; laterodistal corner angular to slightly pointed; lateral margin strongly curved medially close to base and uncus lobe then broadening slightly towards distal margin, lateral margin usually smooth near laterodistal corner but occasionally with one or two small wart-like outgrowths. Each uncus lobe on ventral (outer) surface with curved broad ridge from mediiodistal corner almost to basal part of uncus where ridges nearly meet (fig. 19). Surface of uncus lobes covered with short erect hairs along margins, especially medial margin; ventral (outer) surface with very few hairs; dorsal (inner) surface with strong erect hairs at bases of uncus lobes. Uncus with some strong erect hairs laterally where uncus lobes and basal part of uncus are joined.

Female operculum. – Operculum brownish, darker on lateral margin close to lateroproximal corner. Lateral margin weakly concave distal of lateroproximal lobe; laterodistal corner angularly rounded; distal margin weakly concave on lateral half, weakly convex on medial half; mediiodistal corner broadly rounded; medial margin short and weakly convex; lateral and medial margin of each operculum convergent from base.

Female abdomen. – Abdomen little shorter than head and thorax together. Dorsal part of tergites cas-

teous; sternites and ventral parts of tergites little paler. Tergites without darker spots near lateral margin. Tergites with thin whitish dusting but without distinct pattern. Posterior margins of tergites 3-5 with some short and slender dark spines laterally but spines continuing more medially on tergite 5, posterior margins of tergites 6-7 with more numerous and longer spines along whole length, of tergite 8 with scattered long spines medially. Sternite 7 with angularly rounded posteromedial emargination.

Female genitalia. – Dorsal part of pygofer almost castaneous, ventral part more brownish; distal part of ovipositor sheath dark castaneous brown. Dorsal margin of pygofer shorter than three preceding segments, in lateral view weakly concave; ventral margin weakly convex. Ovipositor sheath not reaching as far as apex of caudodorsal beak; anal valve not reaching as far as ovipositor sheath.

Measurements in mm ( $\delta$ : n = 5;  $\eta$ : n = 1). – Body length:  $\delta$ : 43.5-47.0 ( $44.7 \pm 1.0$ ),  $\eta$ : 39.5; head width:  $\delta$ : 13.0-13.9 ( $13.6 \pm 0.3$ ),  $\eta$ : 14.0; maximum pronotum width:  $\delta$ : 13.8-15.0 ( $14.5 \pm 0.4$ ),  $\eta$ : 15.0; tegmen length:  $\delta$ : 52.5-55.5 ( $54.1 \pm 1.1$ ),  $\eta$ : 54.0.

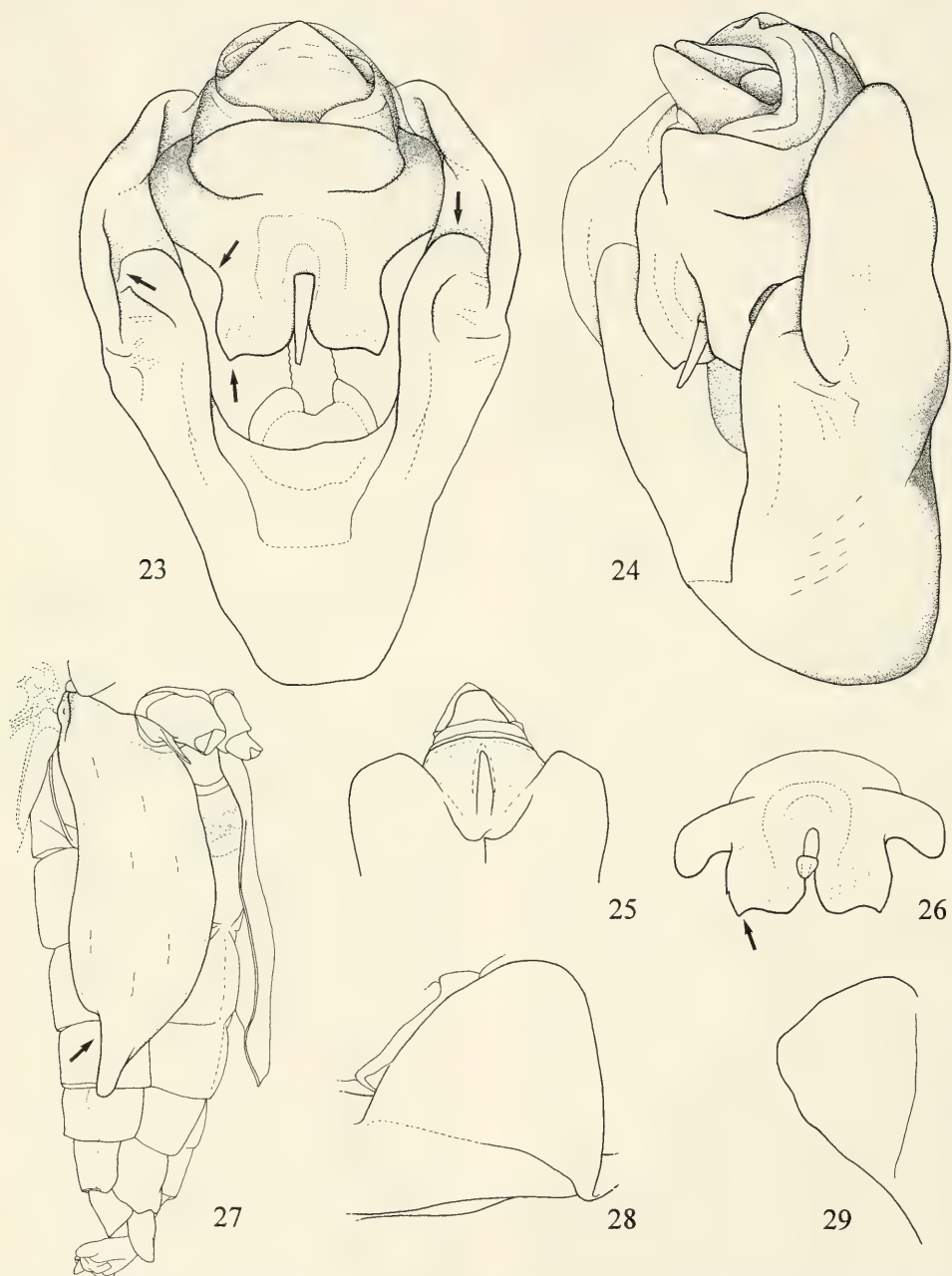
### Distribution (fig. 3)

*P. bocki* is distributed throughout Indo-China (Laos, Thailand, Vietnam) and southern China.

### Remarks

Moulton (1923: 101) already pointed out that the 'Type  $\delta$  and only known specimen' was labelled as cited above. Since both the locality label and the identification label are Distant's, this specimen is designated as lectotype.

Material examined. – CHINA: Cheli [Yunjinghong], Yunnan, 550 m, 30.iv.1957, 1  $\delta$  (IZAS); Emei [Emei Shan], Sichuan, 500 m, 22.vii.1974, 1  $\delta$  (NWAS); Jinghong [Yunjinghong], Yunnan, 3.iv.1991, 1  $\delta$  (NWAS); Mengla, Yunnan, 30.iv.1984, 1  $\delta$  (NWAS); Menglun, Yunnan, 10.v.1984, 1  $\delta$  (NWAS); Yaoqu, Yunnan, 1600 m, 4.v.1991, 1  $\delta$  (NWAS); Yiwubanna, Yunnan, 650 m, 1.v.1964, 4  $\delta$  (IZAS); Yunnan, 5.v.1957, 1  $\delta$  (SUU); VIETNAM: Cochinchine, 1878, Pierre, 1  $\delta$ , 1  $\eta$  (MNHN); LAOS: Haut Mékong, Vieng Vai, 23.v.1918, R.V. de Salvaza, 1  $\delta$  (BMNH); Luang Namtha [Louang Namtha], N. Laos, 4.v.1994, Y. Miyake, 4  $\delta$  (SUU); Luang Prabang, Pan Houei Ket [Ban Houay Ket], 17.iii.1920, R.V. de Salvaza, 1  $\delta$  (BMNH); THAILAND: Khao Yai NP, 800 m, 14.iv.1988, M.G. Allen, 3  $\delta$  (BMNH); Khao Yai NP, 850 m, 19.iv.1988, T.W. Harman, 1  $\delta$  (ZMAN); Khao Yai, Nakorn Nayok [Nakhon Nayok], ca. 800 m, 14.vi.1983, Kuroko, Moriuti, Arita & Yoshiyasu, 1  $\delta$  (OPU); Phuping Palace [Phuping Palace], Changmai [Chang Mai] Prov., North Thailand, v.1983, Y. Komiya, 1  $\eta$  (SUU); same data, 15.vi.1983, 1  $\delta$  (OPU); Saraburi [Sara Buri], 15.iv.1973, Y. Yoshiyasu, 1  $\delta$  (SUU); LOCALITY UNCERTAIN: Sumatra or Siam, Bock,  $\delta$  lectotype *Dundubia bocki* Distant (BMNH).



Figs. 23-29. *Platylomia ficulnea* (Distant, 1892), male, paralectotype Karen Hills. – 23, pygofer and uncus in ventral view; 24, pygofer and uncus in right lateroventral view; 25, pygofer in dorsal view; 26, uncus in anterior view; 27, abdomen and right operculum in lateroventral view; 28, right timbal covering; 29, right katapimeral lobe.



***Platylomia ficulnea*** (Distant, 1892)  
(figs. 3, 23–29)

*Cosmopsaltria ficulnea* Distant, 1892a: 102. – Lectotype ♂ (here designated) of *Cosmopsaltria ficulnea* Distant: 'Carin Ghecu / 1300-1400 m / L. Fea II-III.88' [printed] and 'Cosmopsaltria / ficulnea / type Dist.' [Distant's handwriting].

*Cosmopsaltria ficulnea*. – Distant 1892b: 154, xii, pl. XV figs. 21–21b; Fea 1897: 608.

*Platylomia ficulnea*. – Distant 1906a: 106; Distant 1906b: 61; Distant 1912: 49; Kato 1932: 166; Liu 1940: 115; Metcalf 1963: 617.

*P. ficulnea* is closely related to *P. radha* and *P. bocki* but can easily be distinguished from both species by the presence of the markings on the tegmina. *P. ficulnea* and *P. radha* are the only species of the *P. radha* group with attenuate apices of the opercula. The structure of the genitalia of both species is also very similar but in *P. ficulnea* the basal pygofer lobes are narrower and the uncus lobes do not have a flange on the lateral margin but occasionally they have a small pointed protuberance.

## Description

Body brownish to castaneous with some parts of head and thorax lighter; mesonotum with median and paramedian fasciae partly developed; tegmina with infuscations at basal veins of second, third, fifth, and seventh apical cells, and at apices of longitudinal veins of apical cells. Opercula broad and attenuated at apex.

Head. – Postclypeus and anteclypeus brown; postclypeus little swollen, in dorsal view about as long as distance between frontoclypeal suture and anterior margin of pronotum. Vertex brown but lateral parts, central part of supra-antennal plates, part posterior of eyes and area enclosed by ocelli darker; posterior margin with pair of dark brown spots close to eyes. Genae and lori brown. Frontoclypeal suture as in *P. radha*. Rostrum as in *P. radha*; reaching posterior margin of hind coxae.

Thorax. – Pronotum distinctly broader than head. Pronotal disc brown but sometimes with greenish tinge, anterior margin and medial area paler; disc immediately posterior of anterior margin between paramedian lobes with indistinct to dark brown transverse band that is broadly interrupted medially; central fasciae not developed except for two brownish triangular markings with their bases at pronotal suture; transverse part of pronotal suture with black band that does not continue laterally to level of markings on lateral part of pronotal collar. Anterolateral part of pronotal collar concolorous with pronotal disc, remainder of paler than disc; posterior margin black and sometimes broadening slightly in posterior corners; anterolateral corner angular or with small but distinct lateral tooth; posterolateral corner rounded.

Mesonotum brown, somewhat darker on posterior half of disc and sometimes with greenish tinge on paler parts; median fascia brown, concolorous with posterior half of disc so indistinguishable there; paramedian fasciae on anterior half of disc castaneous and running immediately medial of mesonotal fissures, narrow near anterior margin of disc then broadening and slightly curved medially; mesonotal fissures slightly paler than remainder of mesonotal disc; anterior margin of disc with castaneous triangular markings immediately lateral of mesonotal fissures; lateral fasciae absent. Cruciform elevation concolorous with anterior half of mesonotal disc but anterior arms sometimes paler. Katepimeral lobe (fig. 29) shorter than broad at base; apex rounded. Surface of katepimeral lobe concave in dorsoventral direction and convex in longitudinal direction; surface covered with short, almost waxy hairs, margins with slightly longer, fine hairs. Apex of katepimeral lobe just reaching over base of operculum.

Tegmina and wings. – Tegmina almost entirely hyaline with indistinct brownish reticulation along distal margin and in apical cells; basal veins of second, third, fifth, and seventh apical cells with distinct brown infuscation, infuscation on base of third apical cell often continuing on anterior basal vein of fourth apical cell; apices of longitudinal veins of apical cells with rounded dark brown spots; basal cell almost completely yellowish fumose except for very narrow hyaline strip along posterior margin. Veins of tegmen ochraceous to brownish but sometimes with greenish tinge, darker along cordial fold, on most cross veins, and on distal of forks in veins. Wings hyaline except for very narrow strip posterior of first anal vein. Veins of wings brownish but sometimes with greenish tinge, medial vein and veins close to wing margin darker.

Legs. – Fore legs brownish; femora posteroventrally with darkened longitudinal stripe; tibiae slightly darkened distally; tarsi slightly darkened, especially distally. Mid legs brownish; tibiae brownish, slightly darkened at base and darkening slightly on distal half towards apex; tarsi little darker than femora. Hind legs brownish; tibiae little darker than femora but less so on band at about one fifth from base; tarsi little darker than femora. Fore femur with gap between middle and distal posteroventral spines shallow and not very broad. Hind tibia with three dorsal spines and four anteroventral spines; spines brownish.

Male operculum (fig. 27). – Operculum broad and attenuate at apex, reaching between anterior and posterior margin of sixth abdominal segment, about (2.5) 2.9 times as long as maximum width distal of constriction; brown but sometimes slightly darker on distal part, lateral margin in lateroproximal corner dark brown to black but lateroproximal corner itself paler. Medial margin distal of constriction smoothly

convex to apex, on distal third appearing concave because of shape of apex. Apex of operculum gully-shaped, lateral of midline, and divergent from abdomen. Lateral margin distal of constriction first convex but concave on distal third. Constriction at 0.3-0.4 of length of operculum, medial concavity very shallow, lateral concavity longer and only slightly deeper than medial concavity, broadest part of operculum distal of constriction 1.1-1.3 times as wide as minimum width in constriction. Distance between opercula at constrictions 0.5-0.7 times as wide as minimum width in constriction. Opercula at point of closest approximation separated for a distance of 0.5-0.6 times maximum width between opercula at constrictions. Operculum close to abdomen on proximal part, distal half slightly divergent from abdomen; surface convex in longitudinal direction near medial and lateral margins only, surface more strongly convex in transverse direction, especially on distal third.

Male abdomen. – Abdomen 1.4-1.5 times as long as head and thorax together. Dorsal part of tergites brown to castaneous with anterior margins of tergites 1-3 and posterior margins of tergites 1-2 ochraceous, posterior margins of tergites 4-6 dark brown, lateral parts always paler; sternites and ventral parts of tergites ochraceous to brownish. Dorsal part of tergites 3-4 (5) with dense white pilosity in anterolateral corners, tergite 4 with paramedian, transverse oblong spots of white dusting close to anterior margin. Posterior margin of tergite 7 with many short dark spinules, of tergite 6 with longer spinules along whole length but few medially, of tergite 5 with few spinules on lateral part. Sternite 7 with posteromedial emargination considerably deeper than in *P. radha*. Timbal covering (fig. 28) brownish to castaneous, about as long as wide; medial margin weakly convex; distal margin rounded; lateral margin weakly convex to straight.

Male genitalia (figs. 23-26). – Ochraceous brown; dorsal part of pygofer somewhat darker. Basal pygofer lobes (fig. 23) as in *P. radha* but not as broad and reaching further between lateral margins of pygofer; hairs on anteroventral margin of pygofer and on pygofer surface enclosed by anteroventral margin as in *P. radha* but slightly shorter and interspersed with occasional long hairs; hairs on outer surface of pygofer as in *P. radha*. Dorsal part of pygofer as in fig. 25. Basal part of uncus short, little globose and narrower than maximum width uncus (fig. 23), near bases of uncus lobes usually with erect hairs but these hairs shorter and thinner than in *P. radha*. Uncus lobes (figs. 23-24, 26) short; medial margin, mediodistal corner and distal margin in *P. radha*, without pointed protuberances; laterodistal corner somewhat produced and bluntly pointed, tip directed to anterior; lateral margin strongly curved medially at base, uncus

lobe narrowest about halfway to distal margin, lateral margin weakly convex from narrowest point in uncus lobe to laterodistal corner; lateral margin sometimes with small pointed protuberance near laterodistal corner. Ventral (outer) surface of uncus lobes virtually smooth. Bases of uncus lobes with erect hairs laterally but only very close to base of uncus and with few erect thick hairs on lateral margin; dorsal (inner) surface with scattered erect thick hairs; ventral (outer) surface with short fine hairs on distal half only.

Female. – Unknown.

Measurements in mm ( $\delta$ : n = 4). – Body length:  $\delta$ : 47.0-55.5 ( $52.0 \pm 3.0$ ); head width:  $\delta$ : 13.5-15.2 ( $14.5 \pm 0.6$ ); maximum pronotum width:  $\delta$ : 14.7-16.5 ( $15.7 \pm 0.6$ ); tegmen length:  $\delta$ : 54.5-62.0 ( $59.1 \pm 2.3$ ).

### Distribution (fig. 3)

This species is so far only recorded from Burma and India (Assam) but the record from Assam (Distant 1906a) could not be confirmed.

### Remarks

*Cosmopsaltria ficulnea* was described from an unknown number of specimens from 'Carin Ghecu' and 'Karen Hills'. The type series of *P. ficulnea* consists of four males, two males at both the MSG and the BMNH. One male in each of these collections bears a type label but neither can be considered to be a holotype as this was not mentioned with the description nor was a lectotype designation ever published. The specimen at MSG with Distant's type label is designated as lectotype. The other three males are labelled as paralectotypes.

Material examined. – BURMA: Ghecu, Carin, 1300-1400 m, ii-iii.1888, L. Fea,  $\delta$  lectotype and 1  $\delta$  paralectotype *Cosmopsaltria ficulnea* Distant (MSG); same data, 1  $\delta$  paralectotype (BMNH); Karen Hills, Doherty, 1  $\delta$  paralectotype (BMNH).

### *Platylomia malickyi* sp. n. (figs. 3, 30-36)

Type material. – Holotype  $\delta$ : 'Thailand 24.4.-1.5.1989 / Changmai Zoo Lichtfalle / 400m, 98°57'E, 18°49'N / Chantaramongkol & Malicky' (IZUT). – Paratypes: VIETNAM: 6 km S. of Dalat [Da Lat], 1400-1500 m, 9.vi-7.vii.1961, N.R. Spencer, 1  $\delta$  (BPBM); Datanca, Dalat [Da Lat], S. Vietnam, 22.v.1992, 1  $\delta$  (SUU); LAOS: Ban Van Eue, Vientiane Province, 15-31.v.1965, 1  $\delta$  (BPBM); same data, 15.v.1966, native collector, 1  $\delta$  (BPBM); Lakhon [Muang Lakhonpheng], 1878, J. Harmand, 1  $\delta$  (MNHN); Muong Om [Muang Hom], Luang Prabang [Louangphrabang], 17.v.1920, R.V. de Salvaza, 1  $\delta$

(BMNH); Sen Kam, Haut Mékong, 29.v.1918, R.V. de Salvaza, 1 ♂ (BMNH); Vieng Vai, Haut Mékong, 23.v.1918, R.V. de Salvaza, 1 ♂ (BMNH); THAILAND: Amphoe Muang Chiang-mai [Chiang Mai], 24.iv.1973, Y. Yoshiyasu, 3 ♂ (SUU); same data, 25.iv.1973, 1 ♂ (SUU); Bang Khun Klang, Doi Inthanon, 18°32'N 98°32'E, 1200 m, 27.iv.1.v.1989, Chantaramongkol & Malicky, light trap, 1 ♂ (IZUI); Chiang Dao, Chiang Mai, 1 ♂, 1 ♀ (SUU); Chiang Mai, 23.iv.1976, S. Saito, 1 ♂ (SUU); Changmai [Chiang Mai] Zoo, 18°49'N 98°57'E, 400 m, 17-24.iv.1989, Chantaramongkol & Malicky, light trap, 4 ♂ (IZUI); same data, 2 ♂ (ZMAN); same data, 24.iv-1.v.1989, 4 ♂ (IZUI); Chiengmai [Chiang Mai], 22.vi.1952, D. & E. Thurman, 1 ♂ (USNM); Doi Suthep, Chiang Mai, N. Thailand, 1.v.1984, T. Endo, 1 ♂ (SUU); Doi Suthep, East slope, 15.vii.1962, E.S. Ross & D. Cavagnaro, 1 ♂ (CASC); Mae Sa, Chiang Mai, 2.v.1984, T. Endo, 1 ♂, 1 ♀ (SUU); Phu Khieo Wildlife Sanctuary, Khon San, Chaiyaphum Province [Changwat Chaiyaphum], N.E. Thailand, 16°30'N 101°46'E, 800 m, evergreen rain forest, at light, 13-15.v.1988, M.J.D. Brendell, 1 ♂ (BMNH); Wiang Pa Pao, Chiang Rai Prov., 2-10.v.1990, 1 ♂ (SUU); BURMA: Maymyo, 29.iv.1901, 1 ♀ (BMNH); Maymyo, v.1910, H.L. Andrewes, 1 ♀ (BMNH).

Other material examined. — CHINA: Dale, Yunnan, 1650 m, 31.vi.1991[?], 1 ♂, 1 ♀ (IZAS); Jingdong [Jinping], Yunnan, 1200 m, 29.v.1956, 1 ♂ (NWAS); Lincang, Yunnan, 1110 m, 23.vi.1980, 1 ♂ (FOYP); Menghaineshan, Yunnan, 1200-1300 m, 24.iv.1957, 1 ♂ (IZAS); Nefu, Yunnan, 1350 m, 2.vi.1980, 1 ♂ (FOYP); Shuangjiang [Mengmeng], Yunnan, vi.1977, 1 ♂ (FOYP); Simao, Yunnan, 1350 m, 11.v.1957, 1 ♂ (IZAS); Xishuangbanna, Yunnan, 750 m, 1 ♂ (IZAS); Yunnan, vi.1953, 1 ♂ (NWAS); THAILAND: Phu Rua, Loei, c. 800 m, 15-19.viii.1987, S. Moriuti, T. Saito, Y. Arita & Y. Yoshiyasu, 1 ♀ (OPU); EXACT LOCATION UNKNOWN: S. Annam, 1918, C.B. Kloss, 1 ♂ (MNKM).

*P. malickyi* and *P. bocki* are the smallest species of the *P. radha* group but *P. malickyi* can easily be distinguished from *P. bocki* by the presence of at least some distinct markings on the tegmina and the more elaborate light-dark pattern on the pronotum and mesonotal disc. *P. malickyi* displays a large amount of variation in the markings on the tegmina but some distinct markings are always present. The pronotum and mesonotal disc also show considerable variation in the degree of darkening; in some cases the black posterior margin of the pronotal collar and the black band across the transverse part of the pronotal suture completely enclose the pale area on the posterior part of the pronotal collar.

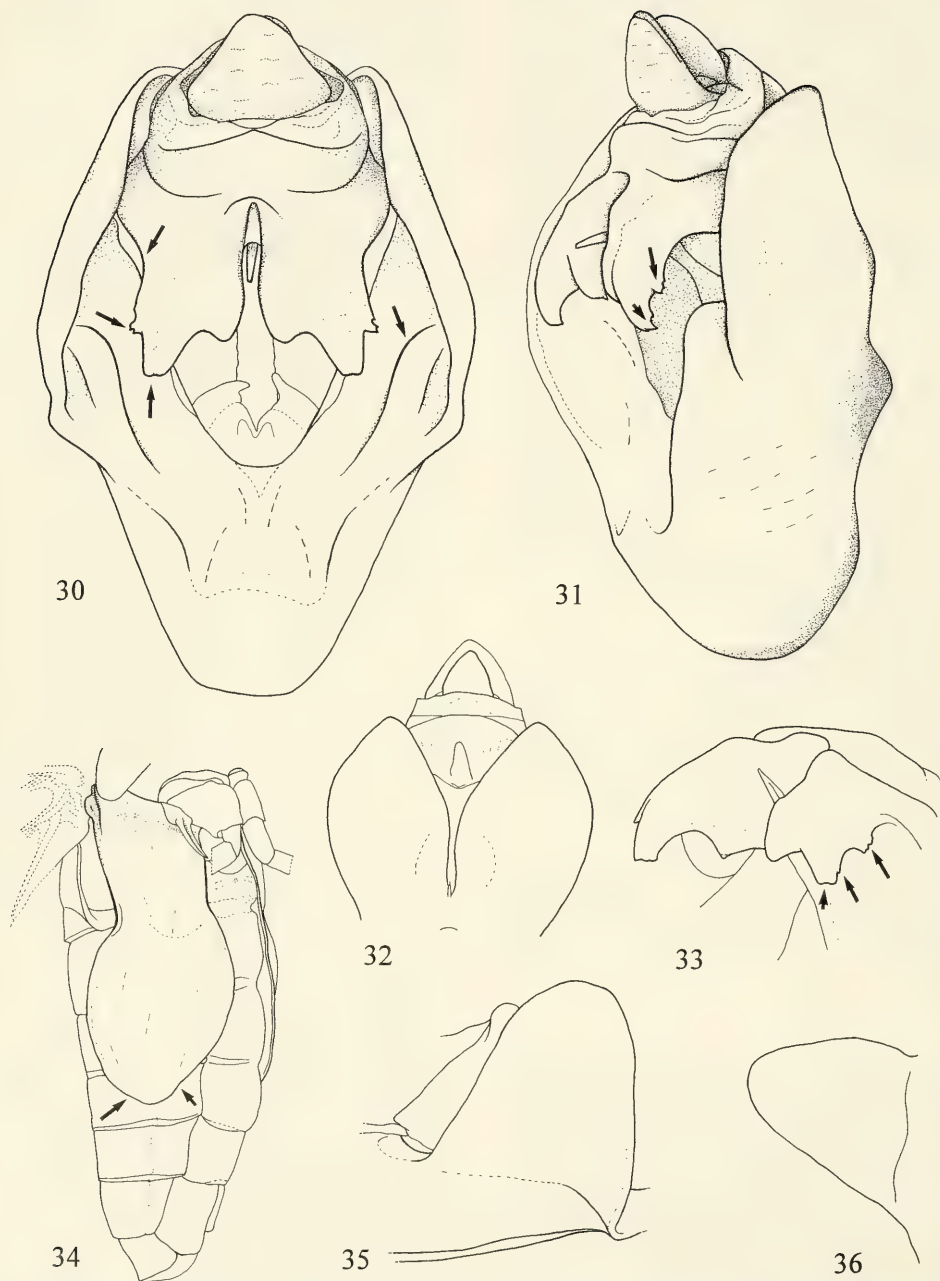
## Description.

Body ochraceous brown to castaneous brown with darker pattern on head and thorax, ventral parts paler than dorsal parts; opercula short and rounded at apex; legs predominantly brownish. Tegmina usually with markings at basal veins of second, third, fifth, and seventh apical cells, and at apices of longitudinal veins of apical cells.

Head. — Postclypeus brown to castaneous but paler along clypeal suture and lateral margins, dorsal part usually somewhat darker than ventral; postclypeus little swollen, in dorsal view about as long as distance between frontoclypeal suture and anterior margin of pronotum. Anteclypeus concolorous with ventral part of postclypeus or somewhat darkened on lateral surfaces. Vertex brownish to castaneous but paler on supra-antennal plates and area posterior of supra-antennal plates, pale parts sometimes extending as far as posterior margin; area around ocelli with black marking that just or just not reaches frontoclypeal suture anteriorly, marking posteriorly usually not reaching posterior margin of vertex but if reaching margin then enclosing brown spot medially at margin and extending laterally towards eyes along margin; posterior margin with pair of black spots close to eyes. Genae ochraceous brown to brown but darker just below antennae. Supra-antennal plates with one or more curved grooves, posterior groove joins lateral part of frontoclypeal suture. Frontoclypeal suture semicircular to distinctly trapezoid, medial part much broader than distance between lateral margins of lateral ocelli. Rostrum ochraceous brown to brown, darkened at tip only, reaching almost to distinctly beyond posterior margin of hind coxae but never further than halfway sternite 1.

Thorax. — Pronotum slightly to distinctly broader than head. Pronotal disc mainly brownish to castaneous, anterior margin and area enclosed by central fasciae paler, central fasciae darker and sometimes almost blackish, broadening posteriorly and forming distinct dark brown to black triangular spots that usually meet at posterior margin of disc; disc immediately posterior of anterior margin with dark brown to black transverse band that is interrupted medially and narrows laterally, band at level of interruption connected with central fasciae; transverse part of pronotal suture with dark brown to black band that is connected with central fasciae; medial part of band largely on disc, lateral part largely on collar. Pronotal collar ochraceous brown to brown with black posterior margin that broadens in posterior corners, lateral part collar occasionally entirely dark except anteriorly; collar lateral of disc darker, sometimes with exception of area around lateral tooth; dark area on lateral part of collar always connected with dark band on transverse part of pronotal suture and occasionally also connect-





Figs. 30-36. *Platylomia malickyi* sp. n., male, paratype Muong Om. – 30, pygofer and uncus in ventral view; 31, pygofer and uncus in right lateroventral view; 32, pygofer in dorsal view; 33, uncus in right anterolateral view; 34, abdomen and right operculum in lateroventral view; 35, right timbal covering; 36, right katapimeral lobe.

ed with black posterior margin of collar; anterolateral corner with small lateral tooth, ranging from blunt and angular to pointed; posterolateral corner rounded but sometimes part of margin only weakly convex. Mesonotum ochraceous brown to castaneous; median fascia usually distinct, dark brown to black and broadened about halfway between anterior margin and cruciform elevation; paramedian fasciae on anterior half of disc dark brown to black and running immediately medial of mesonotal fissures, fasciae narrow near anterior margin of disc then broadening and curved medially till they meet or almost meet with median fascia where latter is broadened; paramedian fasciae on posterior half of disc present as dark brown to black markings of varying size in front of cruciform elevation, only rarely extending anteriorly and meeting with paramedian fasciae on anterior half of disc; mesonotal fissures ochraceous to ochraceous brown, much paler than any other part of mesonotal disc; anterior margin of disc with narrow dark brown to black triangular spots immediately lateral of mesonotal fissures; lateral fasciae on anterior half of disc present as black markings at anterior margin of disc and these markings sometimes merging with triangular spots lateral of mesonotal fissures; lateral fasciae on posterior half of disc ranging from indistinct dark brown spots lateral of cruciform elevation to distinct black fasciae reaching halfway to anterior margin, lateral fasciae posteriorly often fused with remnants of paramedian fasciae in front of cruciform elevation. Cruciform elevation somewhat darker than mesonotal fissures, posterior margin at least laterally dark brown to blackish, sometimes also medially. Katepimeral lobe (fig. 36) rather variable of shape, shorter or longer than broad at base; apex rounded to slightly angular. Surface of katepimeral lobe almost flat to weakly concave along dorsal margin, covered with short hairs only. Apex of katepimeral lobe only just to distinctly reaching over base of operculum.

Tegmina and wings. — Tegmina almost entirely hyaline with indistinct brownish reticulation along distal margin and sometimes in apical cells; basal veins of second and third apical cells along whole length with dark brown markings that sometimes extend for short distance along longitudinal veins back to base of tegmen and may cause the markings to merge, fifth and seventh apical cells usually with smaller dark brown spots but these spots sometimes absent or indistinct; apices of longitudinal veins of apical cells with rounded dark brown spots but these spots sometimes absent or indistinct on posterior part of tegmina; basal cell yellowish to pale brown fumose. Veins of tegmen brownish, darker on most cross veins and parts where veins meet or split. Wings hyaline. Veins of wings brownish, medial vein, and veins close to wing margin darker.

Legs. — Fore legs ochraceous to brownish; femora posteroventrally with darkened longitudinal stripe, apically with dark brown ring that may be interrupted dorsally, anterior and anteroventral surface often somewhat darkened; tibiae brown, dorsal surface with paler stripe on basal quarter to half; tarsi brown. Mid legs ochraceous brown; femora sometimes darkened anteriorly and posteriorly at apex; tibiae darkened dorsally at base and on apical quarter; tarsi brown. Hind legs ochraceous; femora sometimes with very indistinct dorsal stripes; tibiae darkened dorsally at base and with darker ring just before apex; tarsi ochraceous brown. Fore femur with gap between middle and distal posteroventral spines shallow to deep, narrow.

Male operculum (fig. 34). — Not very long, reaching just beyond anterior margin of fifth to just beyond anterior margin of sixth abdominal segment, 2.1-2.3 times as long as maximum width distal of constriction; ochraceous to brown, lateral margin darkened close to lateroproximal corner of operculum. Medial margin distal of constriction convex but occasionally less convex for some distance in distal third. Apex of operculum rounded, only rarely with a tendency to be slightly angular, tip from just medial to just lateral of midline. Lateral margin distal of constriction strongly convex to apex. Constriction at 0.4-0.5 of length of operculum, lateral concavity longer and deeper than medial concavity, broadest part of operculum distal of constriction 1.4-1.6 times as wide as minimum width in constriction. Distance between opercula at constrictions about 1.0-1.1 times as wide as minimum width in constriction. Opercula at point of closest approximation separated for a distance of 0.4-0.5 times maximum width between opercula at constrictions. Surface of operculum convex except at level of constriction thus creating impression of transverse fold at level of constriction.

Male abdomen. — Abdomen about 1.2-1.3 times as long as head and thorax together. Dorsal part of tergites unicolorous brownish to castaneous; sternites and ventral parts of tergites somewhat paler. Lateral parts of tergites 2-4 with thin whitish dusting, dusting on other tergites without distinct pattern. Only posterior margin of tergite 7 with short dark spinules. Sternite 7 with very shallow posteromedial emargination. Timbal covering (fig. 35) brownish, paler than dorsal part of tergites, about 1.0-1.2 times as long as wide; medial margin virtually straight; mediodistal corner, distal margin and laterodistal corner rounded; lateral margin almost straight, convergent with medial margin.

Male genitalia (figs. 30-33). — Pygofer brown to castaneous on dorsal side, remainder paler; uncus brown to castaneous, often paler on basal part and adjoining part of uncus lobes. Basal pygofer lobes (fig.

30) narrower than and not as broadly rounded as in *P. radha*; hairs on anteroventral margin of pygofer erect and not very long, decreasing in length only little towards basal lobes and continuing on pygofer surface enclosed by anteroventral margin, pygofer surface anterior of medial part of anteroventral margin with scattered hairs. Dorsal part of pygofer as in fig. 32. Basal part of uncus short, little globose and narrower than maximum width uncus (figs. 30-31), near bases of uncus lobes with occasional short erect hairs. Uncus lobes (figs. 30-31, 33) broad; medial margin weakly concave to straight; medioidistal corner rounded, occasionally with short blunt spine on dorsal (inner) side; distal margin with narrowing lobule on lateral half, apical margin of lobule curved dorsad (inwards) and two-tipped, each tip broad and very short, lateral margin of lobule often with short blunt spine that is curved dorsad (inwards); laterodistal corner angular, usually with two short but pointed protuberances and often a third one more proximal on lateral margin; lateral margin shallowly concave. Ventral (outer) surface of uncus lobes with short grooves running toward lateral margins of distal lobules. Ventral (outer) surface of uncus lobes with many short, thin erect hairs on proximal half and several thicker erect hairs close to basal part of uncus; dorsal (inner) surface of uncus lobes with long, thick erect hairs near lateral margin on proximal half, otherwise with many short, thin erect hairs, especially close to margins.

Female operculum. — Operculum pale brownish, lateral margin dark brown to black except at lateroproximal lobe. Lateral margin evenly convex distal of lateroproximal lobe; laterodistal corner angularly rounded; distal margin weakly concave to evenly convex; medioidistal corner broadly rounded; medial margins short and convex and strongly divergent.

Female abdomen. — Abdomen 0.9-1.0 times as long as head and thorax together. Dorsal part of tergites castaneous brown but on tergites 1-2 paler, posterior margins darker, tergites 3-6 with indistinct darker spots near posterolateral margin; sternites and ventral parts of tergites paler but less so on segments 6-7. Tergite 2, lateral parts of tergites 3-4 and medial parts of tergites 5-7 with thin whitish dusting. Posterior margins of tergites 3-6 with short dark spines laterally, of tergite 7 with more numerous and longer spines along whole margin, of tergite 8 with scattered spines except laterally, medial spines more slender than paramedial spines. Sternite 7 with angular posteromedial emargination.

Female genitalia. — Lateral and ventral part of pygofer brownish, dorsal part more castaneous but paler along mid-line; distal part of ovipositor sheath castaneous. Dorsal margin of pygofer shorter than three preceding segments, in lateral view weakly concave; ventral margin weakly convex. Ovipositor sheath

reaching as far as apex of caudodorsal beak; anal valve not reaching as far as caudodorsal beak.

Measurements in mm ( $\delta$ : n = 5;  $\varphi$ : n = 3). — Body length:  $\delta$ : 40.0-43.0 ( $41.7 \pm 0.8$ ),  $\varphi$ : 38.0-39.5 ( $38.8 \pm 0.6$ ); head width:  $\delta$ : 12.3-12.8 ( $12.6 \pm 0.1$ ),  $\varphi$ : 13.1-13.6 ( $13.5 \pm 0.3$ ); maximum pronotum width:  $\delta$ : 12.9-13.9 ( $13.3 \pm 0.3$ ),  $\varphi$ : 13.9-14.9 ( $14.5 \pm 0.4$ ); tegmen length:  $\delta$ : 46.5-50.5 ( $48.7 \pm 1.2$ ),  $\varphi$ : 51.0-54.5 ( $52.8 \pm 1.2$ ).

### Variation

The markings on the tegmen show some variation. The spots on the apices of the longitudinal veins of the apical cells are very variable in size and can be present at all apical cells, or gradually weakening from the first to the seventh apical cell and almost be absent there, or very indistinct or absent altogether. Likewise can the markings on the basal veins of second, third, fifth, and seventh apical cells be indistinct and they can even be absent on the basal veins of the fifth and seventh apical cell. The tendency for reduction of wing markings is especially notable in the females from Burma. These specimens are also the specimens with the most extensive darkening on pronotum and mesonotum.

### Distribution (fig. 3)

*P. malickyi* is known from Indo-China (Burma, Laos, Thailand, and Vietnam) and southern China (Yunnan).

### Etymology

The species is named after Dr Hans Malicky who works on Trichoptera and who is one of the collectors of the series that constitutes half of the type material.

### *Platylomia bivocalis* (Matsumura, 1907) (figs. 3, 37-44)

*Cosmopsaltria bivocalis* Matsumura, 1907: 97. — Myers 1929: 137, 222; Kato 1932: 96.

*Platylomia bivocalis*. — Distant 1912: 49; \*Matsumura 1913: 72, pl. IX fig. 2; Schumacher 1915a: 79; Schumacher 1915b: 111; Matsumura 1917: 198, 211; Sonan 1921: [165]; Kato 1925: 20, 44; Kato 1927: 28; \*Matsumura 1930: [15], pl. III fig. 2; Kato 1931: 51 [17], 64 [29]; Matsumura 1931: [1237, text figure]; Esaki 1932: [1704, fig. 3365]; Schmidt 1932: 126; Kato 1932: 206, 217, 328, pl. XXI fig. 4, pl. XXXI fig. N; \*Kato 1933a: pl. 17 fig. 4, pl. 18 fig. 5; Kato 1933b: 11; Kato 1938a: 308; Kato 1938b: 18; Kato 1956: 96, 118, 122, 137; Metcalf 1963: 615; Ishida 1968: 3; Duffels & Van der Laan 1985: 120.

*P. bivocalis* is the only species of the *P. radha* group that does not occur on the mainland of the Southeast Asia or the Thai-Malay Peninsula. It can easily be distinguished from the other species of the group by the



brownish hyaline tegmina, the darker brown infuscation along the veins in at least the distal part of the tegmina, the extensive darkening on tergites, and the pattern of white dusting on tergites 3, 5, 6, and 8.

### Description

Head and thorax brownish, abdomen more castaneous; pronotum with well developed central fasciae; mesonotum with well developed median and paramedian fasciae and with spot-like lateral fasciae; tegmina with markings on basal veins of second, third, fifth and seventh apical cells and on apices of longitudinal veins, but often all veins in distal part of wing somewhat infuscated. Opercula broad and not very long.

Head. – Postclypeus and anteclypeus ochraceous brown to brown, dorsal and anterior parts of postclypeus slightly darker except for anteromedial spot and small area at frontoclypeal suture; postclypeus little swollen, in dorsal view about as long as distance between frontoclypeal suture and anterior margin of pronotum. Vertex brownish, darker on vertex lobes except along eyes and darker on anterior part of supra-antennal plates; posterior margin with pairs of black spots close to eyes and posterior of eyes; ocelli enclosed in brownish to black marking, anterior margin of marking shallowly concave and generally just not reaching frontoclypeal suture, lateral margins of marking either weakly convex or straight, and convergent posteriorly, posterior margin deeply and narrowly concave medially and (almost) reaching anterior margin of pronotum. Genae ochraceous, lori darkened along suture with clypeus. Frontoclypeal suture trapezoid, median part only little broader than distance between lateral margins of lateral ocelli. Rostrum brownish, darkened at extreme tip only; reaching about halfway between to posterior margin hind coxae.

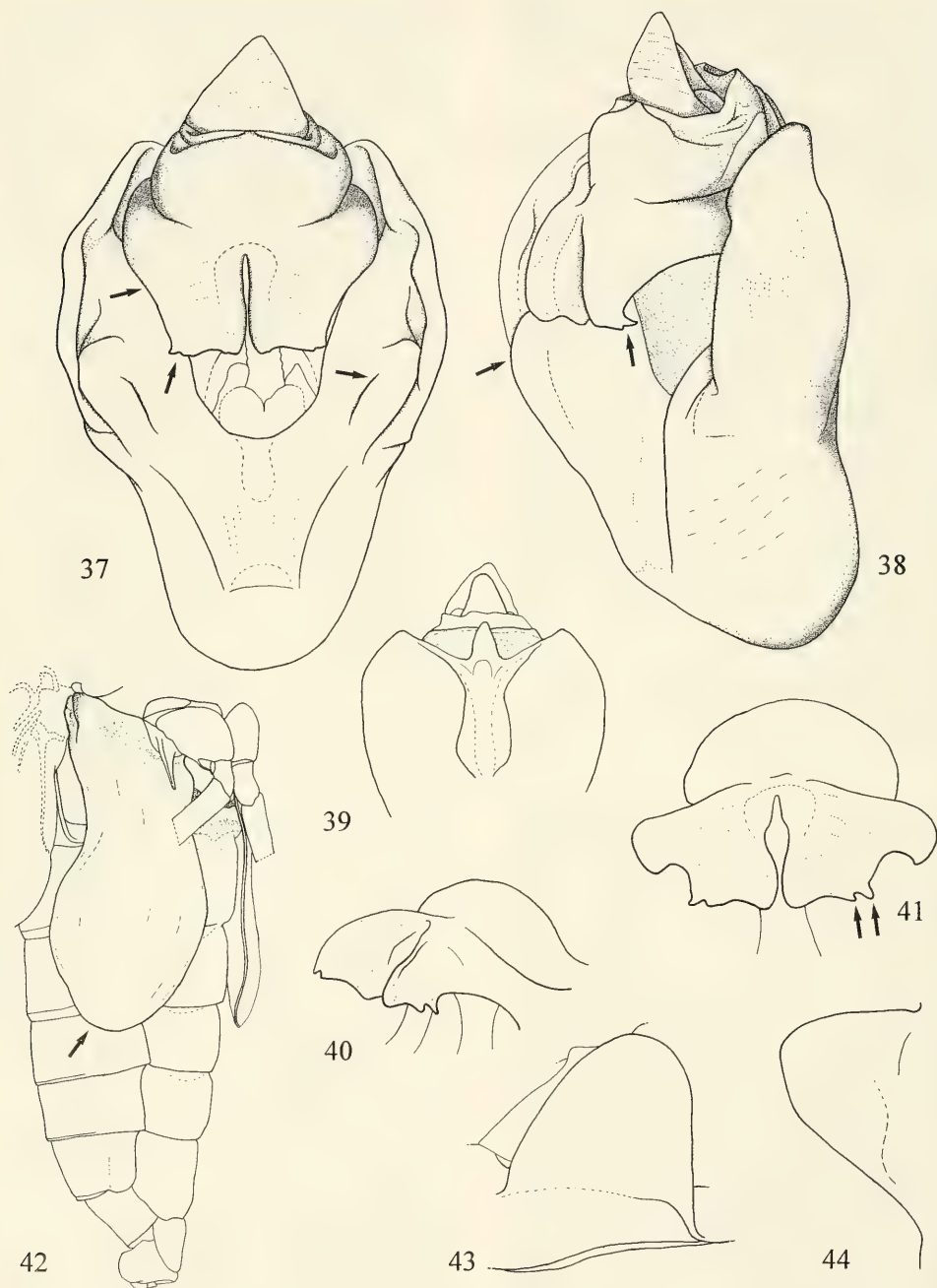
Thorax. – Pronotum distinctly broader than head. Pronotal disc brownish but often with greenish tinge; disc immediately posterior of anterior margin often with dark brown to black, medially narrowly interrupted transverse band; central fasciae distinct and meeting on pronotal suture, sometimes continuing on anterior margin, fasciae broader near anterior and posterior margin of disc, narrow in between and often narrowly interrupted; anterior oblique fissure narrowly darkened; transverse part of pronotal suture with narrow to very narrow dark brown to black band that is often interrupted just lateral of central fasciae, band not continuing laterally across pronotal collar. Pronotal collar concolorous with or slightly paler than pronotal disc, posterior margin black; lateral part of collar with darker brown marking at pronotal suture at lateral lobe of disc; lateral margin at same level slightly darkened; anterolateral corner with blunt lateral tooth. Anterior margins of lateral and paramedian lobes, fissures between these lobes as well

as pronotal suture often with extensive waxy coating. Mesonotum concolorous with pronotum; median fascia black and rather broad, narrowest at anterior and posterior margins of disc; paramedian fasciae on anterior half of disc black, narrow to very narrow and more brownish near anterior margin of disc, slightly curved towards central fascia medially, fasciae on posterior half usually present as black elongated markings in front of and sometimes extending on to anterior arms of cruciform elevation; anterior margin of disc with small blackish triangular markings immediately lateral of mesonotal fissures; lateral fasciae present only as black spots in posterolateral corners of mesonotal disc. Cruciform elevation concolorous with mesonotal disc, posterior margin narrowly black, anterior arms sometimes darkened. Mesonotal disc often with extensive waxy coating on anterior and lateral margins and in depressions of cruciform elevation. Katepimeral lobe (fig. 44) almost as in *P. radha*. Surface of katepimeral lobe concave along dorsal margin and dorsal margin thus curved outwards; surface covered with short, waxy hairs and margin with slightly longer hairs. Apex of katepimeral lobe just or just not reaching over base of operculum.

Tegmina and wings. – Tegmina brownish hyaline but especially along veins in distal and posterior part more brownish infuscated and with indistinct brownish reticulation along distal margin and sometimes in apical cells; basal veins of second, third, fifth, and seventh apical cells usually distinctly infuscated; apices of longitudinal veins of apical cells with indistinct dark brown spots; basal cell yellowish brown fumose except along posterior margin. Veins of tegmen brownish, darker in distal and posterior part. Wings brownish hyaline but paler than tegmina. Veins of wings dark brown, medial and cubital veins paler.

Legs. – Fore legs brownish; femora posteroventrally with darkened longitudinal stripe; tibiae posteriorly and ventrally slightly darkened, dorsally at base dark brown. Mid legs brownish, only tibiae slightly darkened dorsally at base and on apical quarter. Hind legs brownish, tibiae dorsally darkened at base and on apical quarter and tarsi. Fore femur with gap between middle and distal posteroventral spines shallow and broad. Hind tibiae with 3-5 anterodorsal spines and 4-6 anteroventral spines, occasionally with single anterior spine.

Male operculum (fig. 42). – Operculum reaching about halfway fifth abdominal segment, 2.1-2.3 times as long as maximum width distal of constriction; brownish but distal part often somewhat darker, area of lateroproximal corner and usually also part of lateral margin into constriction dark brown to black but margin just distal of lateroproximal corner ochraceous for short distance; some parts covered with waxy coating, usually along margins. Medial margin distal of



Figs. 37-44. *Platylomia bivocalis* (Matsumura, 1907), male, Pingtung Hsien. – 37, pygofer and uncus in ventral view; 38, pygofer and uncus in right lateroventral view; 39, pygofer in dorsal view; 40, uncus in right anterolateral view; 41, uncus in anterior view; 42, abdomen and right operculum in lateroventral view; 43, right timbal covering; 44, right katapimeral lobe.

constriction convex to apex but sometimes less convex to almost straight close to apex. Apex of operculum rounded, tip lateral of midline. Lateral margin distal of constriction first convex but on distal third almost straight or even weakly concave. Constriction at 0.3-0.4 of length of operculum, lateral concavity longer and deeper than medial concavity, broadest part of operculum distal of constriction 1.4-1.6 times as wide as minimum width in constriction. Distance between opercula at constrictions about 1.0-1.3 times as wide as minimum width in constriction. Opercula at point of closest approximation separated for a distance of 0.7-0.9 times maximum width between opercula at constrictions. Operculum close to abdomen; surface of part distal of constriction convex.

Male abdomen. – Abdomen about 1.4 times as long as head and thorax together. Dorsal part of tergites dark castaneous but tergite 1, medial part of tergite 2, sometimes anteromedial part of tergite 3 and lateral parts of tergites 2-6 brownish; sternites and ventral parts of tergites pale castaneous brown. Tergite 1, anterior margin of tergite 3 except medially, tergites 5, 6 and 8 covered with white waxy coating. Posterior margin of tergite 7 with many dark spinules except at extreme lateral part. Sternite 7 with very shallow posteromedial emargination. Timbal covering (fig. 43) brownish, about 1.1-1.2 times as long as wide; medial margin straight to weakly convex; mediiodistal corner, distal margin and laterodistal corner rounded; lateral margin almost straight, convergent with medial margin.

Male genitalia (figs. 37-41). – Yellowish brown; dorsal part of pygofer dark brown except on desclerotised part; uncus lobes darker at bases and along lateral and dorsal margins. Basal pygofer lobes (fig. 37) close to lateral margins of pygofer, narrow and ridge-like, rounded in lateral view (fig. 38); anteroventral margin of pygofer and pygofer surface enclosed by it mostly with short and erect hairs but basal lobes and parts of anteroventral margin leading to them with long erect hairs; pygofer surface anterior of medial part of anteroventral margin with scattered hairs; outer surface of pygofer on posterior half with numerous short hairs interspersed with scattered hairs that increase in length towards posterior margin. Dorsal part of pygofer as in fig. 39. Basal part of uncus rather broad, somewhat globose and with small posteromedial knob that may or may not be distinct (figs. 37-38); surface near bases of uncus lobes with occasional long and thick erect hairs. Uncus lobes (figs. 37-38, 40-41) short and gradually narrowing towards distal margin; medial margins curved dorsad (inwards), weakly concave near aedeagal opening and weakly convex near mediiodistal corners or more or less parallel; mediiodistal corner angularly rounded to rounded and often slightly curved dorsad (inwards); distal

margin slightly curved dorsad (inwards), weakly concave medially and close to laterodistal corner with short, pointed triangular projection; laterodistal corner produced into small, pointed projection; lateral margin evenly concave on distal half. Ventral (outer) surface of uncus lobes with short longitudinal grooves at distal margin, especially near mediiodistal corner, and often with transverse grooves about halfway to distal margin. Ventral (outer) surface of uncus covered with short erect hairs, these hairs more sparse on distal part; dorsal (inner) surface with more numerous and thicker hairs; bases of uncus lobes with long and thick erect hairs both on ventral and dorsal surface, those on dorsal (inner) surface somewhat shorter than those on ventral (outer) surface.

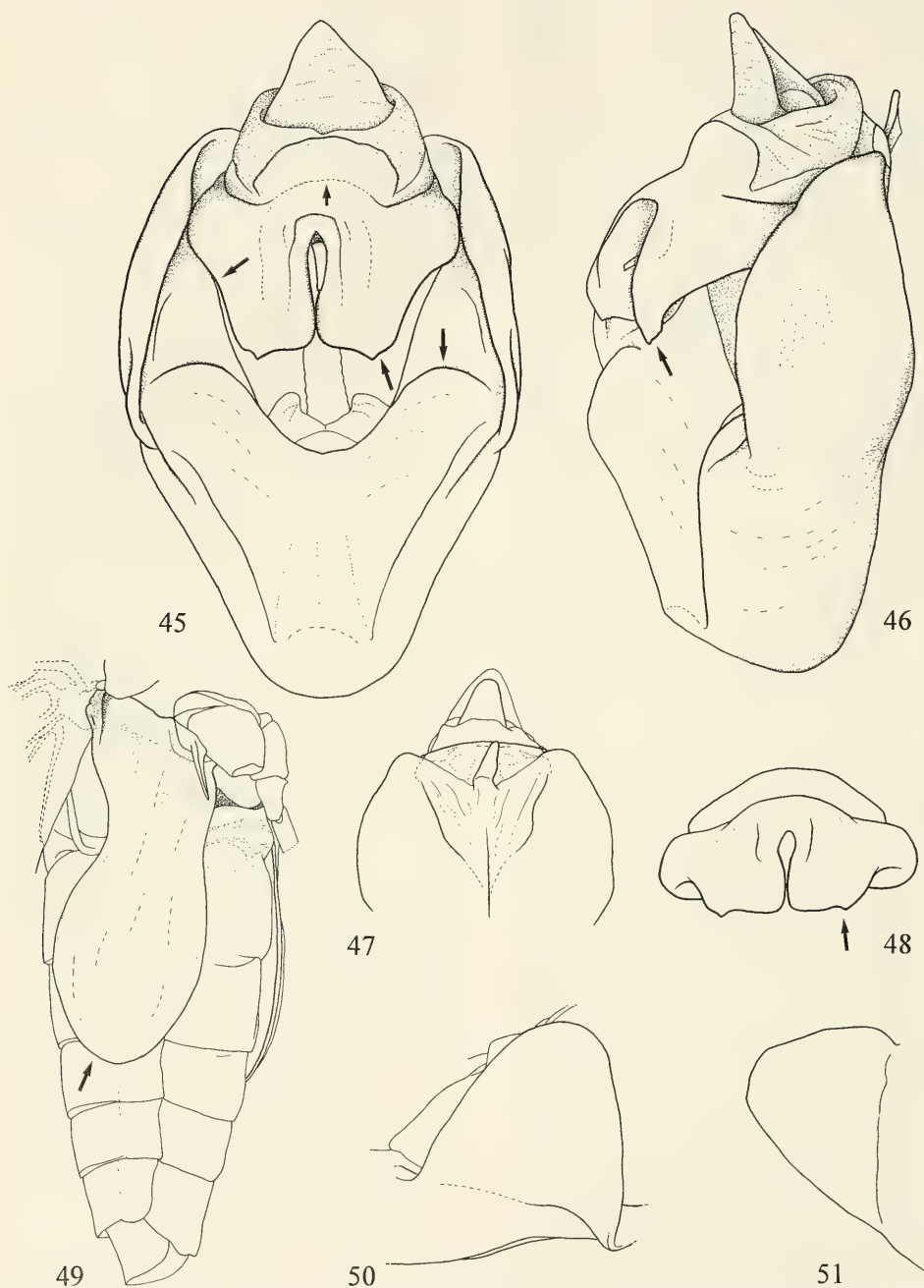
Female operculum. – Operculum greenish to brownish, narrowly dark at meracanthus and along lateral margin but anterior part of lateroproximal lobe brownish. Lateral margin weakly convex distal of lateroproximal lobe but sometimes weakly concave near laterodistal corner; laterodistal corner angular to angularly rounded; distal margin straight or concave for short distance; mediiodistal corner broadly rounded; medial margin straight, medial margins strongly divergent from bases of opercula.

Female abdomen. – Abdomen 1.0-1.1 times as long as head and thorax together. Dorsal part of tergites largely blackish, more brownish near lateral margins, tergites 1-2 brownish medially but in paler specimens also on tergites 3-5 and on anterior margins of tergites 2-3; tergites 3-7 with small oblong spots laterally; sternites and ventral parts of tergites brownish. Tergites 1-3 with whitish dusting laterally, tergites 5-6 and 8 completely covered with white waxy coating. Posterior margins of tergites 3-6 with some short dark spines laterally, of tergite 7 with spines along whole length but fewer medially, of tergite 8 with scattered spines medially. Sternite 7 with angular to angularly rounded posteromedial emargination.

Female genitalia. – Dorsal part of pygofer blackish but in paler specimens more brownish medially, especially at base of caudodorsal beak, remainder of pygofer brownish; distal part of ovipositor sheath blackish. Dorsal margin of pygofer just longer than two preceding segments, in lateral view weakly concave; ventral margin weakly convex. Ovipositor sheath reaching little though distinctly beyond apex of caudodorsal beak; anal valve distinctly not reaching as far as caudodorsal beak.

Measurements in mm ( $\delta$ :  $n = 6$ ;  $\eta$ :  $n = 5$ ). – Body length:  $\delta$ : 47.5-51.5 ( $50.2 \pm 1.3$ ),  $\eta$ : 39.5-44.0 ( $42.0 \pm 1.2$ ); head width:  $\delta$ : 13.3-14.5 ( $14.1 \pm 0.4$ ),  $\eta$ : 13.5-14.0 ( $13.8 \pm 0.1$ ); maximum pronotum width:  $\delta$ : 14.4-16.0 ( $15.5 \pm 0.5$ ),  $\eta$ : 14.5-15.7 ( $15.1 \pm 0.4$ ); tegmen length:  $\delta$ : 50.5-57.5 ( $54.9 \pm 1.8$ ),  $\eta$ : 50.0-55.5 ( $53.7 \pm 1.8$ ).





Figs. 45-51. *Platylomia pendleburyi* Moulton, 1923, male. – 45, pygofer and uncus in ventral view, holotype; 46, pygofer and uncus in right lateroventral view, holotype; 47, pygofer in dorsal view, Khao Luang; 48, uncus in anterior view, Khao Luang; 49, abdomen and right operculum in lateroventral view, Khao Luang; 50, right timbal covering, Khao Luang; 51, right katapimeral lobe, Khao Luang.

### Biological notes

Matsumura (1907) described the song of *P. bivocalis* as consisting of two calls, 'sha sha' and 'ho ho', that are called at the same time. He also stated that the adults often sit under *Pandanus* bushes.

### Distribution (fig. 3)

Taiwan. The record from Japan is a misinterpretation by Metcalf (1963) of data provided by Esaki (1932) and Kato (e.g. 1932, 1933b).

### Remarks

The type material of *P. bivocalis* was not examined. The original description (Matsumura 1907) and subsequently published illustrations (Matsumura 1931; Esaki 1932; Kato 1932) leave no doubt that it is identical with the species described and illustrated here.

Material examined. — TAIWAN: Changlo [Ta-Kung-lu], Pintung Hsien [P'ing-tung Hsien], 16.vi.1976, H. Makihara, 1 ♂, 1 ♀ (SUU); Kankau [Kang-kang], vi.1909, H. Sauter, 1 ♂, 1 ♀ (BMNH); same data, 1 ♂ (USNM); Kankau [Kang-k'ou] (Koshun), iv.1912, H. Sauter, 1 ♂ (USNM); O-Luan-Bi [O-luan-pi], 8.vii.1973, M. Hayashi, 1 ♂ (SUU); same data, 9.vii.1973, 2 ♂, 2 ♀ (SUU); Ouluanpi [O-luan-pi], Pingtung Hsien [P'ing-tung Hsien], 26.v.1982, K.C. Chou & C.C. Pan, 1 ♂ (TARI); Ouluanpi [O-luan-pi] Coast Forest, Pingtung Hsien [P'ing-tung Hsien], 27.vi.1981, T. Lin & C.C. Pan, 3 ♂, 6 ♀ (TARI); same data, 2 ♂, 2 ♀ (ZMAN); S. Formosa, xi.1893, J. De La Touche, 2 ♀ (BMNH).

### *Platylomia pendleburyi* Moulton, 1923 (figs. 3, 45-51)

*Platylomia pendleburyi* Moulton, 1923: 69, 98, 100, 103, 167, pl. V figs. 22-22b. — Holotype ♂: 'Type' [printed on round label with red margin], 'Peninsular Siam, / Nakon Sri Tamarat / Khao Luang / 3300 FT. / April 1<sup>st</sup> 1922. / H.M. Pendlebury' [printed except for altitude and date], '*Platylomia pendleburyi* / Type ♂ Moulton / 1922' [Moulton's handwriting] (BMNH) [examined].

*Platylomia pendleburyi* — Metcalf 1963: 623.

*P. pendleburyi* is the only species of the *P. radha* group confirmed from Peninsular Thailand and is as yet restricted to that area. *P. pendleburyi*, *P. radha*, and *P. ficulnea* are the largest species of the *P. radha* group. *P. pendleburyi* can easily be distinguished from *P. radha* by the presence of distinct markings on the tegmina, and from *P. ficulnea* by the rounded and shorter opercula.

### Description

Body brownish, medial part of tergites more castaneous; pronotum with small (sometimes split) median spot only; mesonotum with four black markings on posterior margin; tegmina with markings on basal veins of second, third, fifth, and seventh apical cells,

and at apices of longitudinal veins. Opercula broad and not very long, divergent from abdomen.

Head. — Postclypeus and anteclypeus brownish, dorsal part of postclypeus slightly darker except for small area at frontoclypeal suture; postclypeus little swollen, in dorsal view about as long as distance between frontoclypeal suture and anterior margin of pronotum. Vertex brownish but darker on vertex lobes, on lateral part of supra-antennal plates and posterior of eyes; area between ocelli blackish. Genae and lori brownish but sometimes with greenish tinge, upper part of genae slightly darker. Frontoclypeal suture and rostrum as in *P. bivocalis*.

Thorax. — Pronotum slightly to distinctly broader than head. Pronotal disc brownish but sometimes with greenish tinge, only marking consisting of small (sometimes split) medial spot at pronotal suture. Pronotal collar slightly paler than pronotal disc, sometimes with greenish tinge, posterior margin black; lateral part of collar with indistinct brown marking close to lateral margin of collar; anterolateral corner with pointed lateral tooth at level of broadest point of pronotal disc; posterolateral corner rounded. Mesonotum slightly darker than pronotal disc; paramedian fasciae on anterior half of disc brownish to blackish and narrow, especially at anterior margin of mesonotum, on posterior half of disc present as two black markings in front of anterior arms of cruciform elevation; anterior margin of disc either with or without triangular markings just lateral of mesonotal fissures; lateral fasciae very indistinct or present only as black spots near posterior margin of mesonotal disc. Medial part of cruciform elevation concolorous with pronotal collar, lateral part slightly darker. Katepimeral lobe (fig. 51) shorter than broad at base; apex angularly rounded. Surface of katepimeral lobe almost flat, only weakly concave along dorsal margin; surface covered with short, waxy hairs and margin with slightly longer hairs. Apex of katepimeral lobe just reaching over base of operculum.

Tegmina and wings. — Tegmina faintly yellowish hyaline with a brownish reticulate pattern between veins in distal and posterior part of the tegmina; basal veins of second and third apical cells with narrow brownish clouding along whole length, fifth and seventh apical cells and apices of longitudinal veins of apical cells with rounded brown spots; basal cell yellowish brown fumose except along posterior margin. Veins of tegmen brownish. Wings very faintly yellowish hyaline, very narrowly clouded posterior of first anal vein. Veins of wings brown, darker on basal part of medial vein and on veins close to wing margin.

Legs. — Fore femora brownish, slightly darker on posteroventral longitudinal stripe and on posterior surface near apex; tibiae dark brown but paler on dorsal surface of proximal three quarters; tarsi very dark

brown. Mid legs brownish; tibiae with blackish basal ring, dorsal surface dark brown on apical three quarters and ventral surface dark brown on apical two thirds; tarsi very dark brown. Hind legs brownish; femora ventrally darker at apex; tibiae with blackish basal ring. Fore femur with gap between middle and distal posteroventral spines deeper and narrower than in *P. bivocalis*.

Male operculum (fig. 49). – Operculum reaching about halfway fifth abdominal segment, 2.6–2.9 times as long as maximum width distal of constriction; brownish but sometimes with greenish tinge, distal part sometimes darker, area of lateroproximal corner and lateral margin proximal of constriction dark brown to black and enclosing brownish spot on lateroproximal lobe. Medial margin distal of constriction weakly convex to apex, medial margins almost parallel for some distance. Apex of operculum obtusely rounded. Lateral margin distal of constriction first convex but partly straight on distal third. Constriction at about 0.4 of length of operculum, medial concavity very shallow; broadest part of operculum distal of constriction 1.3–1.4 times as wide as minimum width in constriction. Distance between opercula at narrowest part of opercula about 1.5–1.9 times as wide as minimum width of opercula. Opercula at maximum width of distal part of opercula separated for a distance of about 0.9–1.0 times distance between opercula at narrowest part of opercula. Operculum close to abdomen proximal of constriction only and somewhat divergent from abdomen from level of constriction onwards; surface of part distal of constriction convex and in addition curved towards abdomen laterally.

Male abdomen. – Abdomen about 1.3–1.4 times as long as head and thorax together. Dorsal part of tergites dark castaneous, medially and laterally more brownish; tergites 2–7 laterally with darker brown spots near posterior margin; sternites and ventral parts of tergites brownish, slightly darker on posterior segments. Tergite 8 with thin whitish dusting, dusting on other tergites without distinct pattern. Posterior margin of tergites 5–6 sometimes with few small dark spinules laterally, of tergite 7 with dark spines along whole length. Sternite 7 with very shallow rounded posteromedial emargination. Timbal covering (fig. 50) brownish but sometimes with greenish tinge, 1.1–1.2 times as long as wide; medial margin straight; distal margin and laterodistal corner rounded; lateral margin weakly convex, convergent with medial margin.

Male genitalia (figs. 45–48). – Brownish; dorsal part of pygofer somewhat darker; uncus more castaneous at basal part and bases of uncus lobes. Basal pygofer lobes (fig. 45) and hairs on pygofer as in *P. bivocalis*, but basal lobes narrower. Dorsal part of pygofer

as in fig. 47. Basal part of uncus short, narrower and less globose than in *P. bivocalis* (fig. 45–46), near bases of uncus lobes with occasional long and thick erect hairs. Uncus lobes (figs. 45–46, 48) short and gradually narrowing towards distal margin; medial margins curved dorsad (inwards), straight to concave; mediodistal corner smoothly rounded; distal margin straight but close to laterodistal corner with short, blunt triangular projection; laterodistal corner rounded but continuing into projection on distal margin; lateral margin weakly concave for most of its length but convex at base and near laterodistal corner. Ventral (outer) surface of uncus lobes almost void of grooves near mediodistal and laterodistal corners. Hairs on surface of uncus lobes as in *P. bivocalis* but less dense.

Female operculum. – Operculum brownish, darkened in lateroproximal corner and along lateral margin. Lateral margin distal of lateroproximal lobe first weakly convex but weakly concave near laterodistal corner; laterodistal corner angularly rounded; distal margin weakly convex; mediodistal corner rounded; medial margins short, straight, and divergent.

Female abdomen. – Abdomen about as long as head and thorax together. Dorsal part of tergites castaneous, laterally slightly paler, tergites 3–6 with small oblong spots laterally that almost form line; sternites and ventral parts of tergites brownish. Tergites with thin whitish dusting but without distinct pattern. Posterior margins of tergites 3–4 with few short dark spines laterally, of tergite 5 with short dark spines except medially, of tergites 6–7 with spines along whole length but fewer medially on tergite 6, of tergite 8 with few short spines medially. Sternite 7 with angular posteromedial emargination in median lobe.

Female genitalia. – Dorsal part of pygofer dark castaneous but more brownish medially and just anterior of caudodorsal beak, remainder of pygofer brown; caudodorsal beak and distal part of ovipositor sheath dark castaneous. Dorsal margin of pygofer about as long as four preceding segments, in lateral view weakly concave; ventral margin somewhat more convex. Ovipositor sheath reaching distinctly beyond apex of caudodorsal beak; anal valve reaching about halfway to apex of caudodorsal beak.

Measurements in mm ( $\delta$ :  $n = 3$ ;  $\eta$ :  $n = 1$ ). – Body length:  $\delta$ : 51.0–55.5 ( $53.2 \pm 1.6$ ),  $\eta$ : 48.0; head width:  $\delta$ : 16.0–16.1 ( $16.1 \pm 0.1$ ),  $\eta$ : 16.2; maximum pronotum width:  $\delta$ : 16.2–17.6 ( $16.9 \pm 0.5$ ),  $\eta$ : 17.0; tegmen length:  $\delta$ : 63.0–64.5 ( $64.2 \pm 0.9$ ),  $\eta$ : 66.5.

### Distribution (fig. 3)

*P. pendleburyi* is only known from the type locality on Peninsular Thailand. The records from Banguey Island and Malay 'Archipelago' by Metcalf (1963) are misinterpretations of comments by Moulton (1923).



## Remarks

The collection date on the holotype labels was misread as April 14th 1922 and cited as such by Moulton (1923: 100). No other material was mentioned explicitly in the description so that the other two specimens cannot be considered as paratypes, even though the female now examined was labelled as paratype and a female is mentioned in the description.

Material examined. — THAILAND: Khao Luang, Nakon Sri Tamarat [Nakhon Si Thammarat], 3500-4000 ft, 13.iii.1922, H.M. Pendlebury, 1 ♀ (BMNH); same data, 1 ♂ (MNKM); same data, 3300 ft, 1.iv.1922, H.M. Pendlebury, 1 ♂ holotype *Platylomia pendleburyi* Moulton (BMNH); same data, 2000 ft, 2.iv.1922, H.M. Pendlebury, 1 ♂ (BMNH).

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## *HELICOPSYCHE MALICKYI* SP. N. FROM BORNEO (TRICHOPTERA, HELICOPSYCHIDAE)

Johanson, K. A., 1998. *Helicopsyche malickyi* sp. n. from Borneo (Trichoptera, Helicopsychidae). — Tijdschrift voor Entomologie 140 [1997]: 177-180, figs. 1-10. [ISSN 0040-7496]. Published 26 March 1998.

*Helicopsyche malickyi* sp. n. (Trichoptera: Helicopsychidae) is described from Sarawak, Malaysia. This is the first description of a species of Helicopsychidae from Borneo, and the third species from the Malesian Archipelago.

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Keywords. — *Helicopsyche malickyi* sp.n.; Helicopsychidae; Trichoptera; Malaysia; Borneo.

With the description of *Helicopsyche malickyi* sp.n., the Helicopsychidae now includes 173 extant described species (Johanson 1995, 1997a, Malicky 1994, Malicky & Chantaramongkol 1993) and forms a moderately large group of caddis flies. The highest species numbers are found in Antillean, Indo-Chinese and Ceylonese subregions (Johanson 1997b). The family is mainly confined to tropical and subtropical areas and the larvae seems to prefer stream habitats. The Helicopsychidae species are recognized by having larvae which build dextrally coiled cases made from sand grains glued together by silk. The adults can be distinguished from species in other families by the presence of an abdominal VIth sternal process in most species, and the absence of nigma in both fore and hind wing fork 2.

The Indo-Malayan Helicopsychidae fauna comprises six species: *Cochliopsyche angusta* (Ulmer, 1951); *Helicopsyche boniata* Malicky & Chantaramongkol, 1992; *H. lata* Ulmer, 1951; *H. putula* Malicky & Chantaramongkol, 1992; *H. anaksaku* Malicky, 1995 and *H. anaktangga* Malicky, 1995. However, only *C. angusta* and *H. lata* are previously described from the Malesian Archipelago (Ulmer 1951, 1955, 1957) (fig. 1) and species records indicated absence of Helicopsychidae from Sarawak (Kimmins 1955). The southeast Asian Helicopsychidae fauna is considered richer than indicated by known species number and Huisman (1991) added to the knowledge two undescribed *Helicopsyche* species from Borneo (Sabah) (fig. 1), which remain yet to

be described. The present record from Sarawak thus adds valuable information to the understanding of the biogeographic history of Helicopsychidae in southeast Asia.

### *Helicopsyche malickyi* sp. n. (figs 2-10)

Type material. — Holotype ♂, Malaysia, Sarawak, 1st Div., Semongoh Forest Res., 1°25'N, 110°17'E, 15-19. XI. 1976, Malaise trap over stream [P. S. Cranston]. Natural History Museum, B. M. 1977-19. In Canada Balsam.

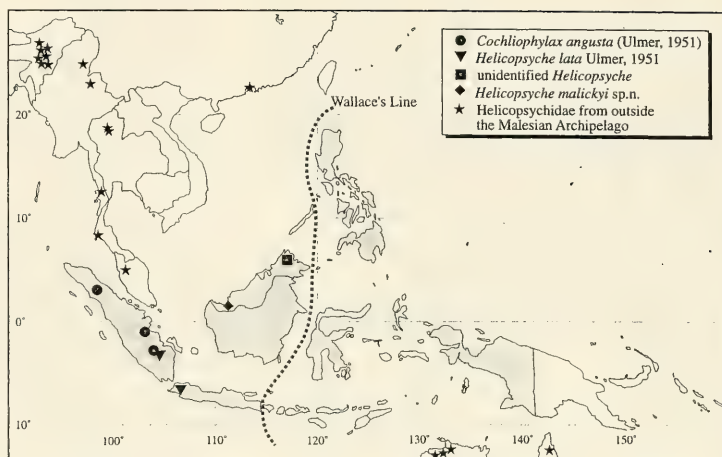
### Description

With the two-jointed maxillary palp *H. malickyi* sp. n. is easily distinguished from the two other Helicopsychidae from the Malesian Archipelago: *C. angusta* and *H. lata* which have four and three joints, respectively. The spherical interantennal warts, distally reduced Cu, in the fore wing and the pointed abdominal VIth sternal process in *H. malickyi* sp.n. indicate a close relation to other Oriental and Palearctic Helicopsychidae. *H. malickyi* sp.n. is similar to the northern Thailand *Helicopsyche namtok* Malicky, 1993, but is easily separated by the IXth segment of the genitalia which is pointed dorsally and ventrally; by the primary branch of the gonocoxite which is larger and parallel-sided; by the bifurcated secondary branch of gonocoxite; and Xth tergum which is slightly shorter. Both scape and maxillary palp are short. In most



Fig. 1.

The distribution of *Helicopsyche* in southeast Asia, New Guinea and northern Australia, with Indonesia, Malesian islands and Philippines emphasized in grey. The *Helicopsyche* species of the Malesian islands are indicated by separate symbols. Other species are mapped as stars.



*Helicopsyche* the vertex is rounded in lateral view and is only slightly visible in lateral view. *H. malickyi* sp.n. is separated from other *Helicopsyche* by the slightly dorsally produced vertex; Xth tergum of the genitalia which is slender in lateral view, gently curved ventrally and with two pairs apical setae; and the posterior margin of the gonocoxal primary branch which is highly undulated, and with two pointed postero-ventral processes.

### Description

Head (fig. 2). – With short scape, about twice the length of the pedicel. Maxillary palp short, the basal joint about as long as scape and distal joint. Eye large in lateral view, covering large parts of head. Cephalic warts rounded in dorsal view and separated by the postero-dorsad produced vertex. Postantennal warts situated between scapes, spherical. Pronotum with two pairs setal warts. Mesonotum and metascutellum with one pair setal warts. Spur formula 1,2,4.

Wings (fig. 3). – Fore wing length 3.0 mm, apically pointed. Fork 1 originates near median part of Dc, broad. Fork 2 about as long as fork 1. Crossvein R–M about 1.5× longer than basal part of R. Fork 3 present, with stalk about half as long as M<sub>3+4</sub> and half M<sub>1</sub> length. Forks 4 and 5 absent. Crossvein between Cu<sub>1</sub> and Cu<sub>2</sub> short. A<sub>1+2</sub> meets posterior wing margin at about one third the wing length. Hind wing length 2.4 mm, with 13 hamuli. All forks absent. M<sub>1+2</sub> about half the R<sub>3+4</sub> length. Cu<sub>1</sub> and Cu<sub>2</sub> run parallel towards wing margin. A<sub>1</sub> and A<sub>2</sub> diverge towards wing margin.

Abdomen. – With sternites II–V well reticulated. VIth sternal process (figs 4 and 5) long, situated posteriorly and with rounded apex.

Genitalia (figs 6–10). – IXth segment trianguloid in lateral view, with dorsal and ventral parts slightly pointed (fig. 6); anterior marginal and short ventral

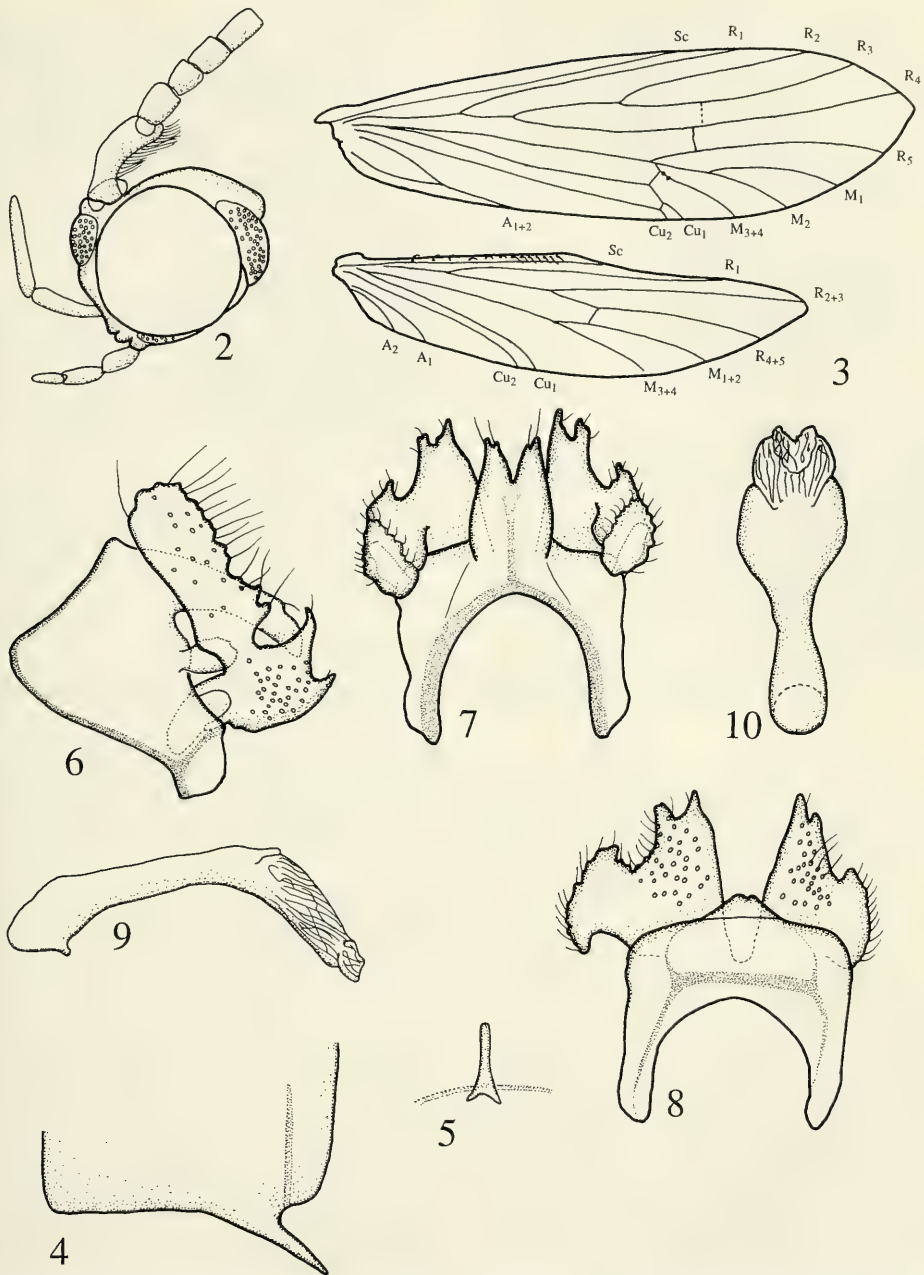
longitudinal apodeme present. The dorsal apodeme continues into a longitudinal central apodeme running into Xth tergum. Anterior part of IXth segment deeply concave in dorsal and ventral view (figs 7 and 8). Posterior part of IXth sternite extends into a short bi-lobed process (fig. 8). Superior appendage situated laterally, long, club shaped and covered by long setae. Gonocoxite, in lateral view (fig. 6), large, with large dorsal primary branch and ventral, bifurcated, posteriorly pointed ventral branch. Primary branch is parallel-sided, with rounded apex, smooth anterior and undulated posterior margins; undulations are associated with short setae. Ventral branch divides into two slightly dorsally curved and pointed processes; in ventral view broad and covered by setae. Xth tergum, in lateral view (fig. 6), slender, parallel-sided and slightly curved ventrad; in dorsal view with convex lateral margins, apex divided by a deep, trianguloid central cleft and two minor lateral clefts, two pairs short setae present near apex. Phallus, in lateral view (fig. 9), slender, with posterior part smoothly curved ventrad in dorsal view (fig. 10), with basal half slender and distal part strongly expanded laterally, about 3× broader than the median part.

### Etymology

*Malickyi*, named after Dr. Hans Malicky in recognition of his contribution to the understanding of the Oriental Trichoptera fauna.

### BIOGEOGRAPHICAL NOTES

By not listing any taxa of *Helicopsyche*, some authors (Kimmins 1955, Malicky 1995) indicate that the number of *Helicopsyche* species in the Malesian Archipelago is low. Thus, when considering the *Helicopsyche*, the Malesian Archipelago may con-



Figs 2-10. *Helicopsyche malickyi* sp. n. — 2, Head, lateral view; 3, Right wings; 4, VIth sternal process, lateral view; 5, VIth sternal process, ventral view; 6, Genitalia, lateral view; 7, Male genitalia, dorsal view; 8, Genitalia, ventral view; 9, Phallus, lateral view; 10, Phallus, dorsal view.

stitute an actual low-diversity area. However, as is the case in other areas (Johanson 1993, Johanson 1997b, Schmid 1993), the family appears to be disjunctively distributed and is expected to be diverse in certain localities. This may be the case for the Helicopsychidae of the Malesian Archipelago as well and is supported by the findings of two more species (Huisman 1991). Thus, it might be expected that more species will appear from that area in the future.

#### ACKNOWLEDGEMENT

Dr. Hans Malicky gave valuable information on *Helicopsyche namtok* Malicky, 1993.

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## A NEW SPECIES OF THE GENUS *AMMOPHILA* KIRBY (HYMENOPTERA, SPHECIDAE) FROM CHINA

Li, Q. & M. Xue, 1998. A new species of the genus *Ammophila* Kirby (Hymenoptera, Sphecidae) from China. – Tijdschrift voor Entomologie 140 [1997]: 181-183, figs. 1-9. [ISSN 0040-7496]. Published 26 March 1998.

*Ammophila heteroclypeola* sp. n. is described from Xingjiang, China. It is closely related to *A. clypeola* Yang et Li.

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Key words. – Hymenoptera; Sphecidae; *Ammophila*; new species; China.

*Ammophila* is the largest genus in the subfamily Sphecinae. It includes 204 medium to large size predatory solitary wasps. Kohl (1906) revised the Palaearctic species, and his work is still a valuable reference for the species identifications. Roth (1928) keyed the species of North Africa. Beaumont (1963) keyed the species of the *nasuta* group. Tsuneki (1967, 1971a, 1971b, 1971c, 1976) provided informative references and keys for the identification of east Asian forms. Bohart & Menke (1976) revised the genera of Sphecidae of the world, and listed 187 species of *Ammophila*. Wu & Zhou (1996) keyed the Chinese species.

In the long course of a study on the fauna of Sphecinae from China, we published some descriptive papers (Li et al. 1994; Li & Yang 1989, 1990; Yang & Li 1989). While investigating the second part of the Sphecinae material deposited in the insect collections of the Zhejiang Agricultural University (ICZAU) and the Institute of Zoology, Academia Sinica (ICIZAS), one new species of *Ammophila* was discovered. We follow Bohart and Menke (1976) in the usage of morphological terms. The abbreviations used in the text are as follows.

- POD Postocellar distance.
- OOD ocellocular distance.
- IODP interocular distance at anterior ocellus.
- IODC interocular distance at clypeus.

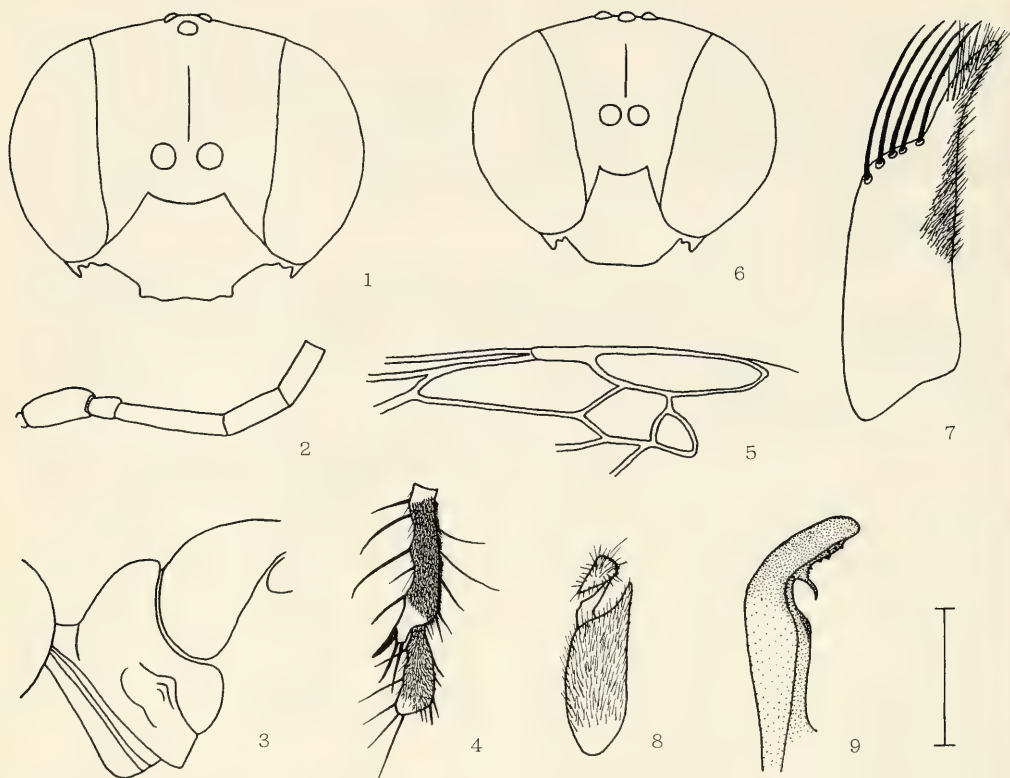
### *Ammophila heteroclypeola* sp. n. (figs. 1-9)

Type material. – Holotype female, China, Xingjiang, Wujiagu, 15.vi.1982, C. Hong, ICZAU. Paratypes (2): 1 female, China, Xingjiang, Yanzhei, 950-1170 m, 6.vii.1958, C. Li, ICIZAS; 1 male, China, Xingjiang, Wusu, 420-460 m, 25.vi.1957, C. Hong, ICIZAS.

### Description

Female. – Body length 14.8-15.1 mm. Black; anterior half of tegulae, abdominal petiole, tergites I-IV and sternites II-IV wholly, tergite V and sternite V partly yellowish red; tibia and tarsi of legs, mandibles and antennae brown to dark brown; apical black portion of abdomen without steel blue luster; wings pale yellowish brown, veins brown to dark brown. Upper clypeus and lower frons areas, pronotal lobe, prepectus, mesopleuron and posterior sides of propodeum covered with dense appressed silver hair; gena, prothorax except collar above, mesosternum, metapleuron, metasternum, propodeum except propodeal enclosure, coxae and femora of legs with sparse appressed silver hair; head and thorax with long, erect, white hair.

Clypeus densely punctate, disc slightly bulging, anterior margin with two lateral teeth (fig. 1). Frons densely punctate, without supra-antennal projection. Vertex sparsely punctate. POD : OOD : IODP : IODC =



Figs. 1-9. *Ammophila heterochypeola* sp. n. – 1-5, Female; 6-9, Male. 1, Head, frontal view; 2, Antenna; 3, Prothorax, lateral view; 4, Tarsi I-II of fore leg; 5, Forewing; 6, Head, frontal view; 7, Gonostyle, lateral view; 8, Volsella, ventral view; 9, Penis valves, lateral view. – Scale line (mm) for figs. 1, 3: 1.16; 2: 1.00; 4: 0.80; 5, 6: 1.34; 7, 8, 9: 0.32.

22 : 30 : 96 : 72. Relative length of antennal pedicel : flagellomere I : II : III : VIII : IX = 13 : 48 : 30 : 28 : 18 : 17.

Pronotal collar (fig. 3) length : width = 34 : 90, shiny, sparsely punctate, with median furrow. Scutum shiny, sparsely punctate, sides of anterior half and medial region of posterior half irregularly, transversely or obliquely rugose-striate. Scutellum shiny, longitudinally rugose-striate and punctate. Metanotum shiny, densely punctate. Mesopleuron with episternal sulcus, other sculptures covered by dense appressed silver hair. Metapleuron coarsely, irregularly rugose-striate. Propodeal enclosure with a median carina, sides of it irregularly obliquely rugose-striate; lateral area of propodeum coarsely, irregularly rugose-striate.

Submarginal cell III of forewing with petiole (fig. 5). Fore legs with foretarsal rakes (fig. 4); hind leg, relative length of 1st tarsomere : 2nd : 3rd = 115 : 65 : 53.

Length of abdominal petiole : tergite I : II = 145 : 125 : 108.

Male. – Body length 15 mm. Similar to female. Tergites I-III and sternites II-III wholly, Tergite IV and sternite IV partly yellowish red; mandibles, antennae, wing tegulae, legs, abdomen except yellowish red area dark reddish brown; veins yellowish brown to brown. Anterior margin of clypeus without tooth (fig. 6). POD : OOD : IODP : IODC = 21 : 30 : 96 : 41. Relative length of antennal pedicel : flagellomere I : II : III : VIII : IX = 14 : 46 : 28 : 28 : 17 : 15. Pronotal collar length : width = 40 : 86, Scutum coarsely, densely and obliquely rugose-striate. Fore leg without foretarsal rake. Hind leg, relative length of 1st tarsomere : 2nd : 3rd = 110 : 59 : 58. Length of abdominal petiole : tergite I : II = 164 : 144 : 102. Genitalia: gonostyle (fig. 7), volsella (fig. 8) and penis valves (fig. 9).

### Etymology

The name is derived from Greek *hetero* (=different) and *clypeola* (also derived from Greek), the name of its closest relative.

## Remarks

This species is closely related to *A. clypeola* Yang et Li, 1990. It can be easily distinguished from the latter by the clypeal disc being only slightly bulging, the sculpture and punctures of the scutum, metapleuron and propodeum, the coloration of the body, appressed silver hair on clypeus, frons, mesopleuron, metapleuron and lateral area of propodeum, and by the male genitalia.

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# IDENTITY OF SOME 'LYGUS' SPECIES DESCRIBED FROM TAIWAN BY B. POPPIUS (HETEROPTERA: MIRIDAE)

Lu, N. & L. Y. Zheng, 1998. Identity of some 'Lygus' species described from Taiwan by B. Poppius (Heteroptera: Miridae). – Tijdschrift voor Entomologie 140 [1997]: 185-189, figs. 1-16. [ISSN 0040-7496]. Published 26 March 1998.

Type specimens of seven 'Lygus' species, described by B. Poppius in 1912-1915 from Taiwan (=Formosa), are studied. The following new combinations are established: *Apolygus eous* (Poppius), *Apolygus fuhoshoensis* (Poppius), *Apolygus kosempoensis* (Poppius), *Lygocoris* (*Neolygus*) *bipuncticollis* (Poppius), *Lygocoris* (*Neolygus*) *v-nigrum* (Poppius). Lectotypes for *Lygus disciger* Poppius, *Lygus kosempoensis* Poppius, and *Lygus sauteri* Poppius are designated, and some additional descriptive data are provided.

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Key words. – Poppius; Taiwan; Miridae; 'Lygus'; lectotype designations; new combinations.

B. Poppius (1912, 1915) described a number of Miridae from the Indo-Pacific region under the all-embracing generic name 'Lygus' (Carvalho 1959, Schuh 1995). The type specimens of a part of these species, preserved in the Hungarian National Natural History Museum, have been examined and briefly noted by Carvalho (1980). Recently, we examined some type specimens of Poppius' 'Lygus' species, collected from Taiwan (=Formosa), which are deposited in the 'Deutsche Entomologische Institut, Eberswalde (DEI)' and the Zoological Museum of the University of Helsinki (ZMUH). The results are here reported, some descriptive data additional to the original descriptions are given, lectotypes are designated, and new combinations established. Measurements are given in millimetres. The terminology for vesical structures follows Yasunaga (1991).

## *Apolygus kosempoensis* (Poppius, 1915) comb. n. (figs. 1-5)

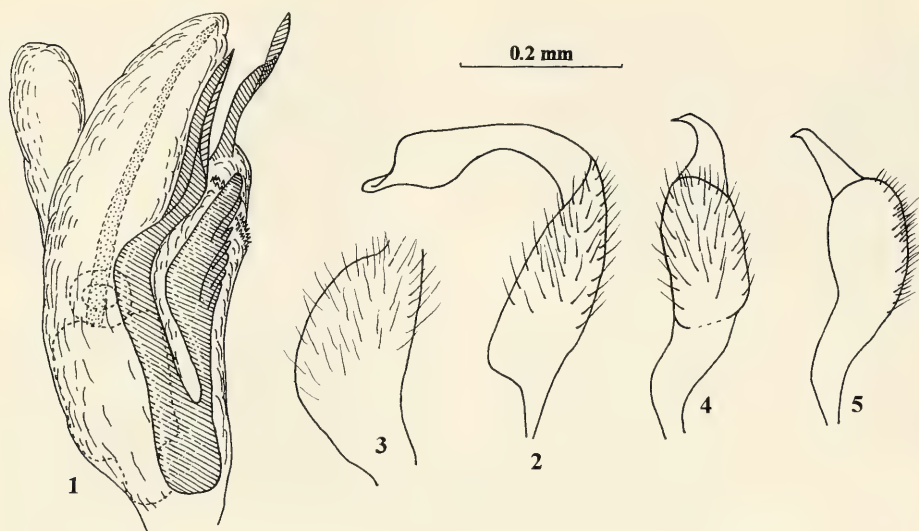
*Lygus kosempoensis* Poppius, 1915: 26. – Lectotype ♂ (present designation) [glued on card, antennal segments 3 and 4, right middle leg, left fore and left hind legs missing]: 'Kosempo Formosa H. Sauter 1911' (print); '7. VII' (print); 'Lygus kosempoensis n. sp. (hand-written)'; 'Mus. Zool. H: fors Spec. typ. No. (print), 10181 Lygus kosempoensis Popp. (hand-written)' [ZMUH]. [examined]

Other material examined. – Paralectotypes 2♂ (present designation): 1♂ [glued on card, all legs missing (except for all coxae)], 'Kosempo Formosa H. Sauter 1911' (print); '7. VII' (print); 'Mus. Zool. H: fors Spec. typ. No. (print), 10182 Lygus kosempoensis Popp. (hand-written)'; 1♂ [glued on card, antennal segment 4, fore legs (except coxae), left middle leg (except coxa) missing], 'Kosempo Formosa H. Sauter 1911' (print); '7. VII' (print); 'Mus. Zool. H: fors Spec. typ. No. (print), 10183 Lygus kosempoensis Popp. (hand-written)' [ZMUH].

Additional description. – Vertex width : head width = 0.30 in male. Cuneus about 1.3 times as long as its basal width. Body length 3.60-3.65, width 1.80-1.85. Head length 0.25-0.28, width 1.02-1.05. Antennal segments lengths 0.41-0.50: 1.30-1.46: 0.69-0.74: 0.55-0.58. Pronotum length 0.78-0.80, width 1.51-1.57. Corium length 1.76-1.87; cuneus length 0.63-0.66; claval commissure length 0.69-0.75.

Male genitalia (lectotype dissected) (figs. 1-5). – Parameres as in figs. 2-5. Vesical spicule absent; ventral sclerite S-shaped; wing-shaped sclerite triangular, outer margin with big spines; lateral sclerite slender, slightly twisted; sublateral sclerite developed, broad; seminal duct swollen greatly, secondary gonopore broad.

Note. – A female specimen [ZMUH], similarly labelled as the type series, but without a 'type' label,



Figs. 1-5. Male genitalia of *Apolygus kosempoensis*. — 1, vesica; 2-3, left paramere; 4-5, right paramere.

was also examined. The following notes refer to this female: Vertex width : head width = 0.42 in female. Body length 3.83, width 1.80. Head length 0.22, width 0.88. Pronotum length 0.96, width 1.68. Corium length 1.84; cuneus length 0.63; claval commissure length 0.83.

Remarks. — On the basis of the body size and form, colour pattern, texture of the body surface and the structure of male genitalia, this species is here placed in the genus *Apolygus* China.

#### *Apolygus eous* (Poppius, 1915) comb. n.

*Lygus eous* Poppius, 1915: 27. — Holotype ♂ [glued on card, left antennal segment 4, right antennal segment 3 and 4, right hind leg (except coxa) missing]: 'Fuhosho Formosa H. Sauter' (printed); '7. IX' (printed), 'Poppius det.' (printed); 'Holotypus' (printed on reddish brown card); 'Lygus eous n. sp.' (hand-written) [DEI]. [examined]

Additional description. — Vertex width : head width = 0.30 in male. Cuneus about 1.7 times as long as its basal width in male. Body length 3.71, width 1.75. Head length 0.34, width 0.91. Antennal segments lengths 0.51: 1.32: 0.80: ? (lost). Pronotum length 0.86, width 1.49. Corium length 1.89; cuneus length 0.59; claval commissure length 0.77.

Remarks. — On the basis of the external appearance and the exposed parameres, this species is here recombined with the genus *Apolygus* China.

#### *Apolygus fuhoshoensis* (Poppius, 1915) comb. n.

*Lygus fuhoshoensis* Poppius, 1915: 31.

Material examined. — Holotype ♂ [glued on card, antennae (except left segment 1), right middle and right hind legs (except coxae) missing, left middle tibia broken near apex, apical part missing]: 'Fuhosho Formosa H. Sauter' (print); '7. IX.' (print); 'Poppius det.' (print); 'TYPUS' (print, on pale brown card); 'Lygus fuhoshoensis n. sp.' (hand-written); 'Holotypus' (print on reddish brown card) [DEI].

Additional description. — Vertex width : head width = 0.29 in male. Cuneus about 1.2 times as long as its basal width in male. Body length 3.92, width 1.71. Head length 0.23, width 0.85. Antennae lost. Pronotum length 0.86, width 1.49. Corium length 1.89; cuneus length 0.59; claval commissure length 0.77.

Remarks. — Judging by the general habitus and the exposed parameres, this species is here placed in the genus *Apolygus* China.

#### *Lygocoris* (*Neolygus*) *bipuncticollis* (Poppius, 1915) comb. n. (fig. 6)

*Lygus bipuncticollis* Poppius, 1915: 25. Holotype ♂ [glued on card, left antennal segment 3 broken (apical part missing), right antennal segment 4 and right hind leg (except left coxa) missing]: 'Kankau (Koshun) Formosa H. Sauter VII.1912' (print); 'Poppius det.' (print); 'Holotypus' (print on reddish brown card); 'Lygus bipuncticollis n. sp.' (hand-written) [DEI]. [examined]

Additional description. — Vertex width : head



width = 0.34 in male. Cuneus about 1.6 times as long as its basal width in male. Body length 3.92, width 2.39. Head length 0.36, width 1.09. Antennal segments lengths 0.71: 1.75: 0.85: ? (lost). Pronotum length 0.94, width 1.62. Corium length 1.90; cuneus length 0.63; claval commissure length 0.69.

Remarks. – The exposed right paramere (fig. 6) clearly proved to be of the typical *Neolygus* form; the body form and colour pattern also show that it is a species of the subgenus *Neolygus* Knight, genus *Lygocoris* Reuter.

***Lygocoris* (*Neolygus*) *v-nigrum* (Poppius, 1915)  
comb. n.**

*Lygus v-nigrum* Poppius, 1915: 31. – Holotype ♂: [glued on card, left antenna, right antennal segments 3 and 4, fore and middle legs (except coxae), left hind tibia and tarsus missing] – 'Taihorinsho Formosa H. Sauter, 1909' (print); '7. IX.' (print); 'Poppius det.' (print); 'typus' (print on pale brown card); 'Lygus fuhoshoensis n. sp.' (hand-written); 'Holotypus' (print on reddish brown card) [DEI] [examined].

Additional description. – Vertex width : head width = 0.31 in male. Cuneus about 1.7 times as long as its basal width in male. Body length 4.14, width 1.76. Head length 0.36, width 0.88. Antennal segments lengths 0.46: 1.42: ?(broken): ? (lost). Pronotum length 0.81, width 1.44. Corium length 1.94; cuneus length 0.72; claval commissure length 0.81.

Remarks. – The body form, colour pattern and the

exposed right paramere indicate that it is a member of the subgenus *Neolygus* Knight of the genus *Lygocoris* Reuter.

***Lygocoris* (*Neolygus*) *disciger* (Poppius, 1915)**

*Lygus disciger* Poppius, 1915: 34.

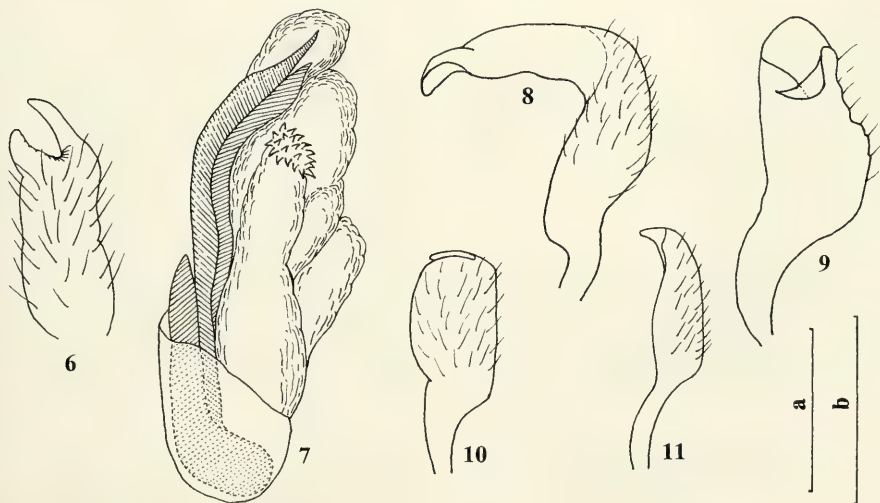
*Lygocoris* (*Neolygus*) *disciger*; Schwartz & Kerzhner, 1997: 252. – Lectotype ♀ (present designation): [left corium and left membrane, both antennae missing] – 'Fuhosho Formosa H. Sauter' (print); '7. IX.' (print); 'Lygus disciger n. sp.' (hand-written); 'Mus. Zool. H. fors Spec. type. No (print), 10176 Lygus disciger Popp. (hand-written)' [ZMUH]. [examined]

Additional description. – Vertex width : head width = 0.37 in female. Cuneus about 1.6 times as long as its basal width in female.

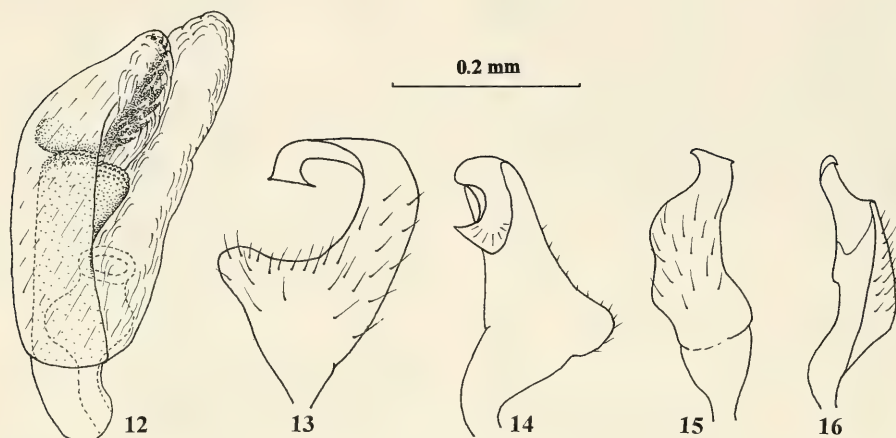
Appendix. – The following descriptive notes are based on specimens collected from China: Guangdong Province (1 ♂) and Yunnan Province (2 ♂, 2 ♀), which we identified as *Lygocoris* (*Neolygus*) *disciger* after comparing with the lectotype.

Descriptive notes. – Vertex width : head width = 0.30 in male.

Male genitalia (figs. 7-11). – Parameres as in figs. 8-11. Vesical spicule slender, bending near apex; with a sclerite structure at centre; with 4 membranous lobes; seminal duct cylindric, secondary gonopore relative small. Body length 3.78-4.00, width 1.49-1.62. Head length 0.25-0.28, width 0.88-0.93. Antennal segments lengths 0.55-0.58: 1.52-1.66: 0.76-0.92:



Figs. 6-11. Male genitalia of *Lygocoris* (*Neolygus*) spp. – 6, Right paramere of *L. bipuncticollis*; 7-11, *L. disciger*. – 7, vesica; 8-9, left paramere; 10-11, right paramere. Scale a: 0.2 mm to fig. 6; b: 0.2 mm to figs. 7-11.



Figs. 12-16. Male genitalia of *Sabactus sauteri*. – 12, vesica; 13-14, left paramere; 15-16, right paramere.

0.50-0.54. Pronotum length 0.63-0.68, width 1.32-1.40. Corium length 1.76-2.05; cuneus length 0.55-0.58; claval commissure length 0.81-0.90.

Remarks. – Schwartz & Kerzhner (1997) place this species in the subgenus *Neolygus* based on the female genitalia, complete basal carina of vertex and tibial spine color; the structure of the vesica, described in this study, also suggests a *Neolygus*-form.

***Sabactus sauteri* (Poppius, 1912) comb. n.**  
(figs. 12-16)

*Lygus sauteri* Poppius, 1912: 303.

*Sabactus sauteri*; Schwartz & Kerzhner, 1997: 256, figs. 35-38. – Lectotype ♀ (present designation) [left antenna, right antennal segment 4 missing]; 'Chip Chip Formosa Sauter II 07-09' (print); 'Lygus sauteri n. sp. B. Poppius det.' (print); 'Mus. Zool. H: fors Spec. typ. No (print), 9932 (hand-written) Lygus sauteri Popp. (print) [ZMUH]. [examined]

Other material examined. – Two other specimens belonging to the type-series, labelled with 'Lygus sauteri' (Mus. Zool. H: fors Spec. typ. No 10191: male; Mus. Zool. H: fors Spec. typ. No 10190: female) which were borrowed along with the lectotype (Mus. Zool. H: fors Spec. typ. No 9932) obviously belong to the subfamily Deraeocorinae (*Deraeocoris* sp.?) and are thus misidentified paralectotypes.

Additional description. – Vertex width : head width = 0.38 in female. Cuneus about 1.6 times as long as its basal width.

Appendix. – The following descriptive notes are base upon examinations of specimens collected from China: Sichuan Province (1♀), Guangxi Province

(1♂, 2♀), Hainan Province (1♀), Yunnan Province (1♂, 2♀) and Taiwan Province (46♂, 54♀ [Bishop Museum]) which we identified as *Sabactus sauteri*, after comparing with the lectotype.

Descriptive notes. – Vertex width : head width = 0.30 in male. Body length 3.92-4.52, width 1.85-2.12. Head length 0.23-0.34, width 0.85-0.88. Antennal segments lengths 0.44-0.48: 1.33-1.41: 0.71-0.87: 0.62-0.69. Pronotum length 0.88-0.99, width 1.53-1.70. Corium length 1.70-1.87; cuneus length 0.58-0.78; claval commissure length 0.61-0.78.

Male genitalia. – Basal part of sensory lobe of left paramere strongly protruded; apex of hypophysis truncate. Hypophysis of right paramere short and broad, apex truncate. Vesical spicule absent; with 4 membranous lobes, the lateral margin of the largest one with several large sclerotized spines, others minutely spinulose on surface; seminal duct short, swollen at middle, secondary gonopore broad.

Remarks. – We follow here the generic placement suggested by Schwartz & Kerzhner (1997). However, the posterior wall of bursa copulatrix of this species lacks the characteristic bifid inter-ramal lobes found in the type species *Sabactus institutus* Distant (Kelton 1955).

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# THE GENUS *HYDROPSYCHE* PICTET, 1834 ON ISLANDS IN THE WEST PACIFIC REGION AND DESCRIPTION OF NEW SPECIES (TRICHOPTERA: HYDROPSYCHIDAE)

Mey, W., 1998. The genus *Hydropsyche* Pictet, 1834 on islands in the West Pacific Region and description of new species (Trichoptera: Hydropsychidae). – Tijdschrift voor Entomologie 140 [1997]: 191-205, figs. 1-40. [ISSN 0040-7496]. Published 26 March 1998.

Species of the genus *Hydropsyche* are largely distributed over the islands of the West Pacific. They are grouped into 4 species groups on the basis of male genitalic characters. The hitherto known species of the 4 groups are listed, and the distributional area of the groups is demonstrated. Among the 57 cited species 16 are newly described: *H. germanorum* sp. n., *H. staphylostirpis* sp. n., *H. taiwanensis* sp. n., *H. vialigni* sp. n., *H. initiana* sp. n., *H. malickyi* sp. n., *H. ambonensis* sp. n., *H. seramensis* sp. n., *H. palawanensis* sp. n., *H. gemellata* sp. n., *H. salki* sp. n., *H. sirimauna* sp. n., *H. suppleta* sp. n., *H. naumanni* sp. n., *H. sulana* sp. n., *H. bacanensis* sp. n. Correspondence: Dr. W. Mey, Museum für Naturkunde, Humboldt-Universität Berlin, Invalidenstr. 43, D-10115 Berlin, Germany.

Key words. – Taxonomy; new species; biogeography; SE Asia; West Pacific Island; Sundaland; *Hydropsyche*; species groups; Hydropsychidae; Trichoptera.

The species of *Hydropsyche* Pictet, 1834 show an interesting rate of endemism and speciation in the islands between Southeast Asia (= SE Asia) and Australia. All of the larger islands have a number of *Hydropsyche* endemics. By contrast, there are no species with a wide distribution over the entire region or with a range through several islands or island groups. Previous records of wide distribution areas for some species proved to be based on the misidentification of some specimens, e.g. *H. hobbyi* Mosely, 1951 described from Borneo and New Guinea in Mosely (1951), corrected by Kimmings (1962), and *H. bryanti* Banks, 1939 recorded from Sumatra, Java and Sumba in Ulmer (1951), corrected in Mey (1998). The high degree of endemism of *Hydropsyche* observed in the West Pacific Region suggests the existence of further, still unknown species on the islands which have not yet been sampled for caddisflies. It is to be expected that Halmahera, Seram, Obi, Sula, Buru, the Lesser Sunda Islands and especially New Guinea will have two to four additional *Hydropsyche* species each. Furthermore, the relatively better investigated Greater Sunda Islands, Sulawesi, the Philippines and Taiwan have diverse caddisfly faunas, which are by no means adequately surveyed.

Unknown *Hydropsyche* species are still to be found in these larger islands and archipelagos.

With this background it is clear, that we have not yet reached the advanced level of faunistic research, which is the prerequisite for any serious discussion of the origin, dispersal or diversity pattern of the genus in the West Pacific Region. In addition, the phylogenetic relationships within *Hydropsyche* have been studied only partially (e.g. Malicky 1977, Mey 1996, Nimmo 1987, Ross 1944). Even the concept of *Hydropsyche* and its probable sistergroup is a matter of much debate (Bueno-Soria 1984, Flint & Bueno-Soria 1987, McFarlane 1976, Nielsen 1981, Ross & Unzicker 1977, Scheffer 1996, Scheffer et al. 1986, Schmid 1979, Schuster 1984, Tanida 1986, Tian & Li 1987). Without a detailed phylogenetic analysis and without adequate knowledge of the existing species and their geographic distributions, it is not possible to use the genus as an example for reconstructing the evolutionary history of the region and its biota. However, the data on *Hydropsyche* so far accumulated are quite sufficient to recognise that the group is an extremely promising candidate for elucidating dispersal or vicariance patterns and tracing them further into the past.

The purpose of this paper is to contribute to the improvement of the faunistic database of the genus. It presents the first records of *Hydropsyche* species from the Moluccas and from Palawan. In addition, a list of all described taxa and their distribution has been compiled. It is thought that this will be the starting point for an enhanced faunistic research in the region, which should subsequently lead to a biogeographic analysis of the genus.

## METHODS

Material examined in this study was obtained from several sources. Most of the caddisfly specimens were collected with a mercury-vapour light source by several entomologists. A portable generator was used as the power unit. The majority of specimens is preserved in 75% ethanol. Examination and drawing of male genitalia was done after the entire abdomen had been cleared in boiling KOH, washed and replaced in ethanol. Illustrations were prepared with the aid of a Wild drawing equipment on a Wild M8 stereo-microscope.

The shape of the genitalic structures in lateral, ventral and dorsal view varies between species. They provide clear characters for species separation and recognition, which are best appreciated by comparing the figures, rather than by long descriptions or written keys. In contrast to the genitalia, the external characters (e.g. coloration, mouth parts, wing venation) of the species are extremely uniform and can not be used in the identification of species.

## DELIMITATION OF THE STUDY AREA

This study concerns the West Pacific region, which covers most of the islands between continental SE Asia and North Australia. Within this vast area the following countries are situated: Indonesia, West Malaysia (Sarawak, Sabah), Brunei, Philippines, Taiwan, Papua New Guinea, Solomon Islands. Hainan is excluded from the present study.

## THE SPECIES-GROUPS OF HYDROPSYCHE IN THE WEST PACIFIC

The *Hydropsyche* species of SE Asia and Australia have not attracted much interest, probably because they are not frequently reported in the literature nor are there many people working with them. Even in discussions of the phylogeny of the genus on a world-wide scale, the South East Asian and West Pacific species have been disregarded. However, the region has at least 4 distinct species groups, which have no further representatives elsewhere (*H. pluvialis* group, *H. formosana* group, *H. hamifera* group, *H. buergersi*

group). Members of the *H. pluvialis* group were not recorded from the Sunda Islands up to now. In addition, the regions bears a number of isolated species, which cannot be assigned to any of the defined species groups (e.g. *H. vasoumittra* Schmid, 1961). A fifth group has a subgeneric name of its own: *Ceratopsyche* Ross & Unzicker, 1977. I do not use this name for the moment, because it implies also a subgeneric level for the other groups. As a consequence, three new genus group names would have to be proposed now or later. The taxonomic treatment of the groups, however, is not the subject of the present article. New names should be proposed in accordance with the results of a sound phylogenetic study. Before such an analysis is published I prefer to group related species into species-groups. Although the groups are informal entities I follow common nomenclatorial practice and use group-names based on the first described species in each group. The definitions of the groups are based entirely on characters of the male genitalic apparatus.

### 1. *Hydropsyche newae* group

*Ceratopsyche* Ross & Unzicker, 1977: 305.  
*morosa* group, Scheffer & Wiggins 1986: 2.  
*silfvenii* group, Malicky 1977: 2.  
*penicillata* group, Schmid 1965: 137.

### Diagnosis

Phallosome sinuate, with the genital opening on the dorsal side between paired phallosomal sclerites; apex of phallosome extending beyond phallosomal sclerites, partially membranous and with spicules or with membranous lobes; dorsolateral membrane simple or complex; 10th segment with two apical appendages (= appendices digitiformis).

### Distribution

Holarctic and Oriental biogeographic region (fig. 1).

### List of species

<i>H. annulata</i> (Ulmer, 1905)	Java
<i>H. germanorum</i> sp. n.	Sumatra
<i>H. orbiculata</i> Ulmer, 1911	Taiwan
<i>H. staphylostirpis</i> sp. n.	Lombok
<i>H. taiwanensis</i> sp. n.	Taiwan
<i>H. vialignii</i> sp. n.	Sumatra

### 2. *Hydropsyche hamifera* group

*bryanti-celebes-annulata* group, auctorum  
*javanica* group, Mey 1990: 414

### Diagnosis

Basis of phallosome simply bent; phallosomal scler-



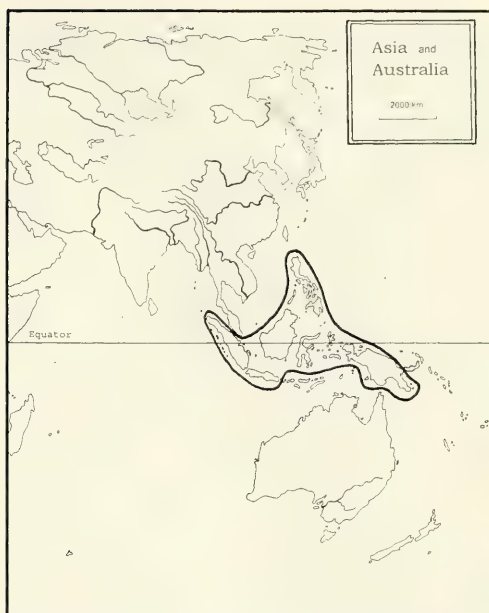
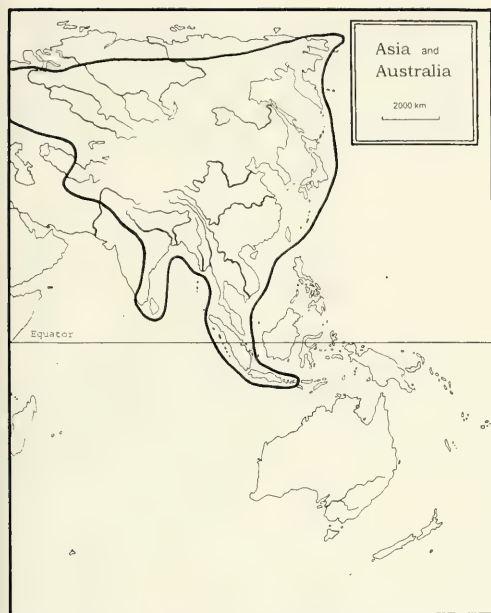


Fig. 1. Distributional area of the *Hydropsyche newae* group. – The map shows the distributional limits in Asia. The entire area of the group includes Northern and Middle Europe and North America.

Fig. 2. Distributional area of the *Hydropsyche hamifera* group.

rites on dorsal side of phallosome fused, forming a ring with a shorter or longer elongation on the ventral side, forming a phallosomal tongue, which gives the apex of the phallosome a trifurcate appearance; dorsolateral membrane with 1 - 3 appendages; 10th segment with apical appendages and a pair of small processes on a flat dorsal side.

### Distribution

Sunda Islands, Philippines, Wallacea biogeographic region, New Guinea (fig. 2).

### List of species

<i>H. ambonensis</i> sp. n.	Ambon
<i>H. bacanensis</i> sp. n.	Bacan
<i>H. bifurcata</i> Mey, 1990	Luzon
<i>H. brueckmanni</i> Mey, 1995	Luzon
<i>H. buenafei</i> Mey, 1998	Negros
<i>H. calawiti</i> Mey, 1995	Mindoro
<i>H. cebuensis</i> Mey, 1998	Cebu, Negros
<i>H. celebensis</i> Ulmer, 1951	Sulawesi
<i>H. davisi</i> Mey, 1998	Negros, Mindanao
<i>H. declinans</i> Mey, 1990	Luzon
<i>H. excelsa</i> Mey, 1990	Luzon
<i>H. fascelina</i> Mey, 1998	Mindanao
<i>H. faurai</i> Navás, 1925	Luzon
<i>H. forcipata</i> Ulmer, 1930	Mindanao
<i>H. gemellata</i> sp. n.	Sulawesi

<i>H. gerostizai</i> Mey, 1998	Negros
<i>H. hamifera</i> Ulmer, 1905	Sulawesi
<i>H. hobbyi</i> Mosely, 1951	Borneo
<i>H. initiana</i> sp. n.	Sumatra
<i>H. isolata</i> Banks, 1931	Borneo
<i>H. javanica</i> Ulmer, 1905	Java
<i>H. luzonica</i> Mey, 1990	Luzon
<i>H. malickyi</i> sp. n.	Sumatra
<i>H. mindanensis</i> Mey, 1998	Mindanao
<i>H. mindorensis</i> Mey, 1995	Mindoro
<i>H. mosehyi</i> Kimmins, 1962	New Guinea
<i>H. muelleri</i> Mey, 1998	Mindanao
<i>H. naumanni</i> sp. n.	Sulawesi
<i>H. negrosensis</i> Mey, 1998	Negros
<i>H. palawanensis</i> sp. n.	Palawan
<i>H. rizali</i> Banks, 1937	Mindanao
<i>H. salki</i> sp. n.	Sulawesi, Moluccas
<i>H. saranganica</i> Ulmer, 1951	Java
<i>H. schintlmeisteri</i> Mey, 1990	Mindanao
<i>H. secundaria</i> Mey, 1998	Mindanao
<i>H. seramensis</i> sp. n.	Seram
<i>H. sirimauna</i> sp. n.	Ambon, Seram
<i>H. sulana</i> sp. n.	Sula
<i>H. suppleta</i> sp. n.	Ambon, Seram
<i>H. unitaria</i> Mey, 1990	Luzon
<i>H. villica</i> Mey, 1990	Luzon
<i>H. sp. n.</i> (Mey, in press)	Talud.

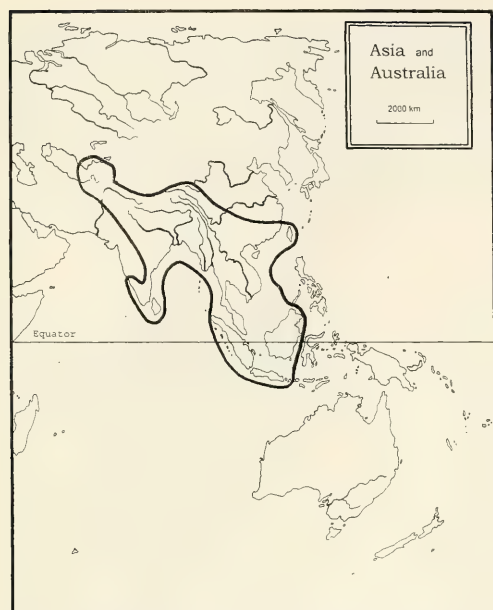


Fig. 3. Distributional area of the *Hydropsyche formosana* group.



Fig. 4. Distribution of the *Hydropsyche buergersi* group.

### 3. *Hydropsyche formosana* group

*Mexipsyche* Ross & Unzicker, 1977: 305-306, sensu Tian & Li 1987: 125-126.

#### Diagnosis

Basis of phallosome simply bent; phallosomal sclerites vestigial or lost; bifid apex of phallosome membranous on dorsal side, sclerotized ventrally and with one or two keels; lateral sides of phallosome with a pair of proximally produced appendages; endophallus nearly as long as phallosome; segment 9 narrowed; segment 10 with apical appendages.

#### Distribution

Oriental biogeographic region (fig. 3).

#### List of species

<i>H. bryanti</i> Banks, 1939	Java, Sumatra
<i>H. banksi</i> Kimmins, 1955	Borneo
<i>H. doctersi</i> Ulmer, 1951	Java
<i>H. formosana</i> Ulmer, 1911	Taiwan, Malaysia
<i>H. irroratella</i> Ulmer, 1951	Java
<i>H. sp. n.</i> (Mey, in press)	Lombok
<i>H. sp. n.</i> (Mey, in press)	Sumatra
<i>H. sp. n.</i> (Mey, in press)	Borneo.

### 4. *Hydropsyche buergersi* group

#### Diagnosis

Basis of phallosome simply bent; phallosomal sclerites small, situated at the tip of phallosome between a pair of sclerotized, large valves; dorsolateral membrane lacking; phallosome with a membranous area on the ventral side, just below the phallosomal sclerites; segment 9 of usual size; segment 10 with short apical appendages.

#### Distribution

Philippines, New Guinea, Solomon Islands (fig. 4).

#### List of species

<i>H. buergersi</i> Ulmer, 1915	New Guinea
<i>H. flynni</i> Korboot, 1964	New Guinea
<i>H. nasuta</i> Ulmer, 1930	Mindanao
<i>H. tapena</i> Kimmins, 1957	Guadalcanal.

The *buergersi* group is established here to summarise 3 species from New Guinea and one Philippine species. They do not belong to any of the aforementioned groups. Interestingly, they show affinities to some species of continental South East Asia, e.g. *H. adonis* (Malicky, 1996), *H. harpagofalcata* Mey, 1995 and *H. napaea* Mey, 1996. The diagnosis of the group is tentative, however. The type of *H. buergersi* Ulmer, 1915 was deposited in the Zoological Mu-

seum Berlin, but could not be found again. Neboiss (1986: 115) reproduced the original drawings. A re-description of *H. buergersi* Ulmer, 1915 together with collecting efforts to obtain new material of related species are necessary to provide more arguments for the monophyly and validity of the group.

### 5. Species incertae sedis

<i>H. ciosi</i> Navás, 1927	Mindanao
<i>H. testacea</i> Navás, 1933	New Guinea.

### DESCRIPTION OF NEW SPECIES

The descriptions are based exclusively on male genitalic characters. The female genitalia are very homogenous and can hardly be used for separating the species. In addition, most species occur sympatrically with other species of the genus, thus rendering the association of sexes doubtful.

Homologies of the phallic apparatus in *Hydropsyche* have been interpreted and named differently by various authors (e.g. Nielsen 1981, Ross & Unzicker 1977, Schmid 1979). The terminology used in this article follows Scheffer & Wiggins (1986: 4-5).

Most of the type material is deposited in the Museum für Naturkunde der Humboldt Universität Berlin (MNHb). Paratypes of some species are in coll. Malicky (Lunz am See). No explicit indication of paratype depository means storage in the MNHB.

### newae group

#### *Hydropsyche germanorum* sp. n. (figs. 5-6)

Type material. – Holotype ♂ (pinned), Indonesia, Sumatra, Sumatera Utara, Medan, Tiga Dolok, 13.ii.1995, leg. E. Diehl, in MNHB. – Paratypes: 5 ♂, same data as for holotype; 21 ♂, same locality, 22.ii.1995, leg. E. Diehl; 25 ♂, same locality, 20.i.1995, leg. E. Diehl; 5 ♂, Indonesia, Sumatra, Sumatera Aceh, Leuser N.P., Ketambe, 22.-24.i.1995, leg. A. Kallies; 3 ♂, 2 ♀, Sumatera Aceh, Calang, Kuala Don, Febr. 1996, leg. A. Kallies; 2 ♂, Indonesia, Sumatra, Sumatera Barat, 12 km E Padang, Mt. Talang, 1600m, 18.ix.1991, leg. A. Schintlmeister.

Description. – External characters: Length of forewing 6.5-7.3 mm. Head and thorax brown, with golden brown pilosity. Eyes black. Antennae yellow, with indistinct darker lines on the articulations of flagellomeres, tip of antennae brown, extending to apex

of forewing. Maxillary palpi brown, with last joint longer than the two preceding together. Labial palpi light brown. Legs yellowish. Forewings yellowish brown, with numerous pale spots dispersed over the wing, somewhat darkened towards outer wing margin.

Male genitalia (fig. 5-6): Segment 10 with short fingerlike appendages. Apical segment of inferior appendage (= harpago) broad, slightly bent and with an oblique tip. Phallosome sinuate, with short apical part. Phallosomal sclerites large, in vertical position on the dorsal side of phallosome. Dorsolateral membrane without appendages, but more proximal a small membranous window with a small spine. Apical membrane of phallosome with indistinct spicules, lateral membrane with a small lobe, directed distally.

Etymology. – The species is named in honour of the many German entomologists, who collected material of this species on several places in Sumatra.

Remarks. – The species is related to *H. annulata*, but differs by the vestigial spicules of the apical membrane, the lacking dorsolateral appendages and by the broad apical segments of the inferior appendages. Both species occur sympatrically in Padang, Sumatera Barat.

#### *Hydropsyche staphylostirpis* sp. n. (figs. 7-9)

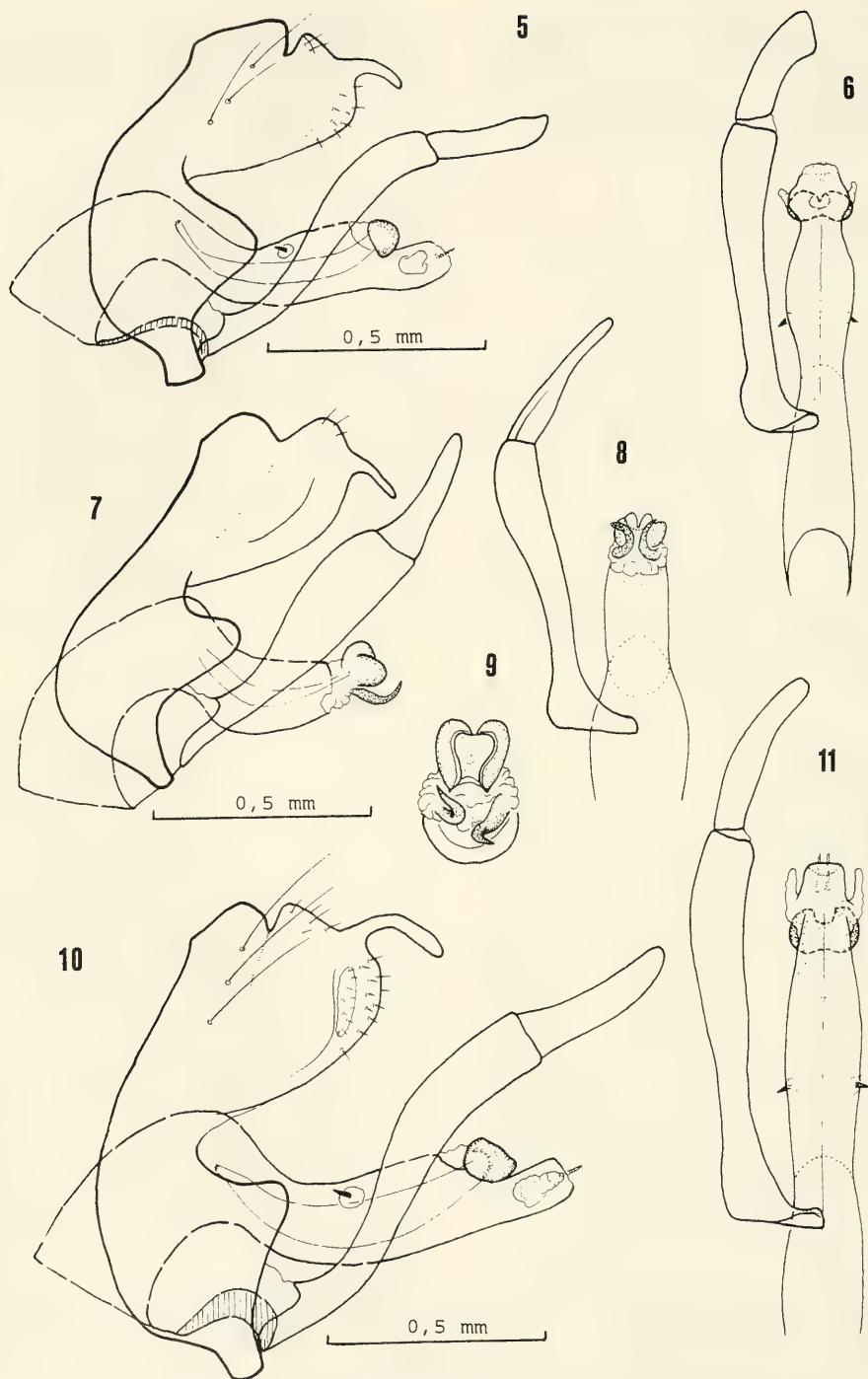
Type material. – Holotype ♂ (pinned), Indonesia, Lombok, Narmada, 17.iii.1927, leg. Dr. [B.] Rensch, in MNHB. – Paratypes: 1 ♂, 1 ♀, same locality, 14.iii.1927.

Description. – External characters: Length of forewing 7 mm, wings golden brown, reticulate pattern weakly developed. Other characters as in *H. germanorum* sp. n.

Male genitalia (figs 7-9): Segment 9 shortened and slender in lateral view. Segment 10 with nearly straight apical appendages. Inferior appendages with a broad basal segment (= coxopodit) and an elongate second segment (= harpago). Phallosome sinuate, ending with the phallosomal sclerites. Dorsal membranous area without appendages, but extending ventrally to form a ventral membranous part beneath the phallosomal sclerites and equipped with two curved spines. Phallosomal sclerites excavated apicolaterally.

Remarks. – The new species is very remarkable by the reduced apical part of the phallosome and the pair of spines beneath the phallosomal sclerites. It is a quite isolated species in the newae group, but shows affinities to *H. annulata*.





Figs. 5-11. Male genitalia of *Hydropsyche* spp. – 5-6, *H. germanorum* sp. n., 5, lateral, 6, ventral; 7-9, *H. staphylostirpis* sp. n., 7, lateral, 8, ventral, 9, tip of phallosome, caudal; 10-11, *H. vialigni* sp. n., 10, lateral, 11, ventral.

***Hydropsyche vialigni* sp. n.**  
(figs. 10-11)

Type material. – Holotype ♂ (pinned), Indonesia, Sumatera Utara, Medan, Tiga Dolok (Holzweg 2), 22.ii.1995, leg. E. Diehl, in MNHB. – Paratypes: 2♂, same data as holotype.

Description. – External characters: Length of forewing 9-9.5 mm. Coloration and wing patterns as in *H. germanorum* sp. n.

Male genitalia (figs. 10-11): Segment 10 with curved apical appendages. Apical segment of inferior appendages rounded apically, not dilated. Phallosome sinuate, with short apical part behind phallosomal sclerites. Phallosomal sclerites large, on dorsal side of phallosome. Dorsolateral membrane without appendages, but more proximally a small membranous spot with a short spine. Apical membrane of phallosome with 2 protruding spicules, lateral membrane with small lobes, reaching tip of phallosome.

Remarks. – The new species is closely related to *H. germanorum* sp. n., but can be distinguished easily by the larger size of the species and by the unmodified second joint of the inferior appendages.

***Hydropsyche taiwanensis* sp. n.**  
(figs. 12-13)

Type material. – Holotype ♂ (in alcohol), Taiwan, Fushan I., 25.xi.1995, leg. H. J. Wu, in MNHB. – Paratypes: 1♂, 2♀, same data as holotype; 1♂, Taiwan, Fushan Botanical Garden, 18.iv.1996, leg. S. H. Yen.

Description. – External characters: Length of forewings 8 mm. Other characters as in *H. germanorum* sp. n.

Male genitalia (figs. 12-13): Segment 9 and 10 not divided dorsally by a depression. Apical appendages of segment 10 broad, short and medially bent. Inferior appendages with a short first segment (= coxopodit), second segment (= harpago) elongate, with a rounded tip. Phallosome sinuate. Dorsolateral appendages with a short spine. Apical part of phallosome with long, membranous appendages, ending with a short spine. 2 small spikes in the apical membrane. Phallosomal sclerites large and broadly fused.

Remarks. – *H. taiwanensis* sp. n. is very similar to *H. orbiculata*. The species can be separated by the form and structure of the phallic apparatus.

***hamifera* group**

***Hydropsyche initiana* sp. n.**  
(figs. 14-16)

Type material. – Holotype ♂ (pinned), Indonesia, Sumatera Utara, Sipirok, 25.ii.1995, leg. E. Diehl, in MNHB. – Paratypes: 1♂ (pinned), same data as holotype; 10♂, Indonesia, Sumatera Utara, Medan, Tiga Dolok (Holzweg 2), 20.i.1995 (5♂), 13.ii.1995 (2♂), 22.ii.1995 (3♂), leg. E. Diehl.

Description. – External characters: Length of forewing 7-8 mm. Coloration and wing pattern as in *H. germanorum* sp. n.

Male genitalia (figs. 14-16): Segment 10 flat, without a carina. Segment 9 with apical appendages and with a pair of small dorsal processes fused at the base to form a Y-like structure. Apical segment (= harpago) of inferior appendages slender and pointed. Phallosome with a bifid membranous apical part, armed with a spine. Ventral tongue of phallosomal sclerites not reaching the tip of phallosome. Dorsolateral membrane with broad appendages, ending with a long spur each.

Remarks. – *H. initiana* sp. n. is related with *H. javanica* and *H. malickyi* sp. n. The shape of the 10th segment and the structure of the phallic apparatus clearly separates the species.

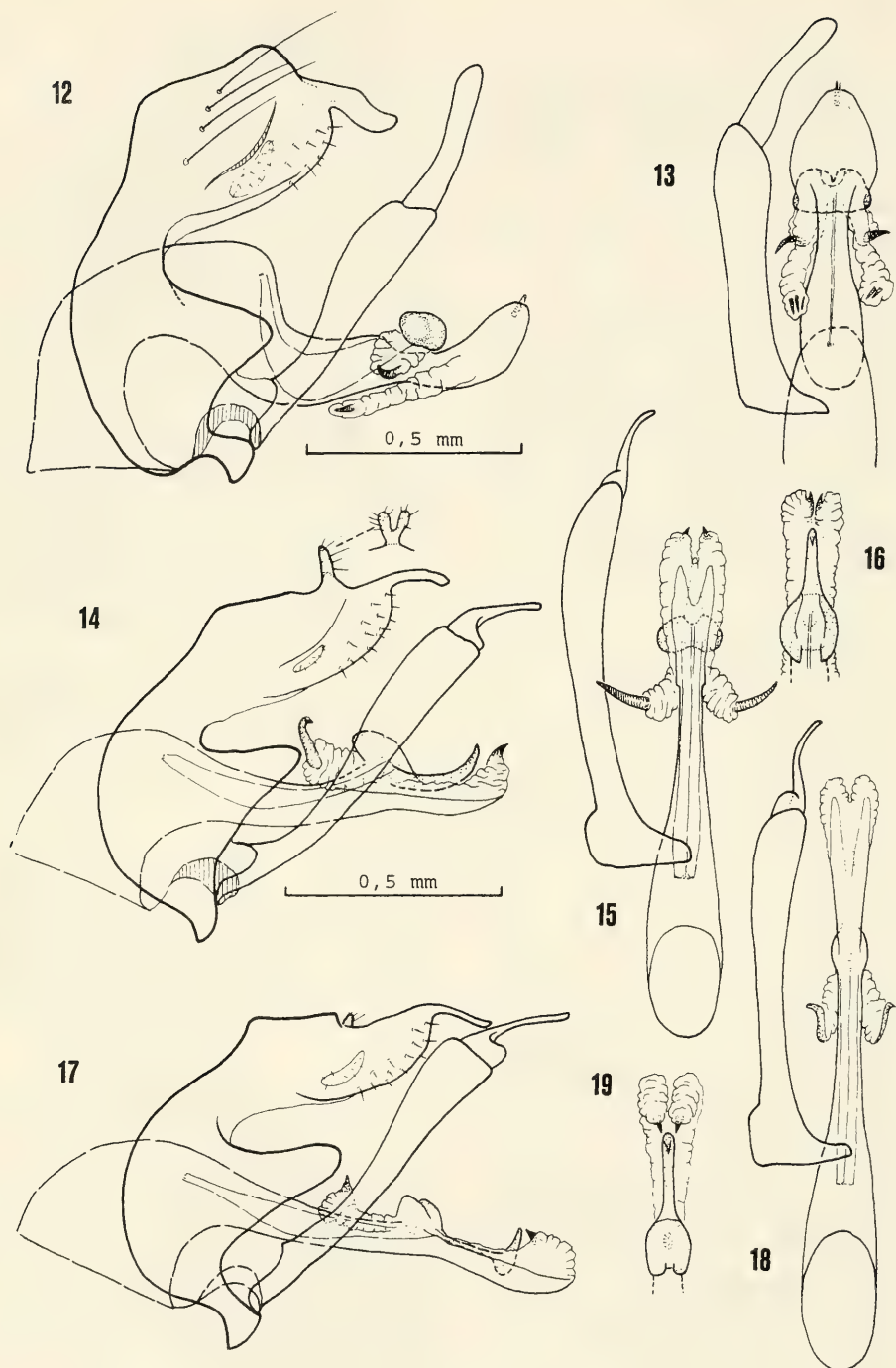
***Hydropsyche malickyi* sp. n.**  
(figs. 17-19)

Type material. – Holotype ♂ (pinned), Indonesia, Sumatera Utara, Medan, Tiga Dolok (Holzweg 2), 22.ii.1995, leg. E. Diehl, in MNHB. – Paratypes: 6♂, same data as holotype; 2♂, same locality, 13.ii.1995; 3♂, same locality, 20.i.1995, all leg. E. Diehl; 1♂, Sumatera Aceh, Tibbing Raja, 15.ii.1996, leg. A. Kallies.

Description. – External characters: Length of forewing 8-8.5 mm. Coloration and wing pattern as in *H. germanorum* sp. n.

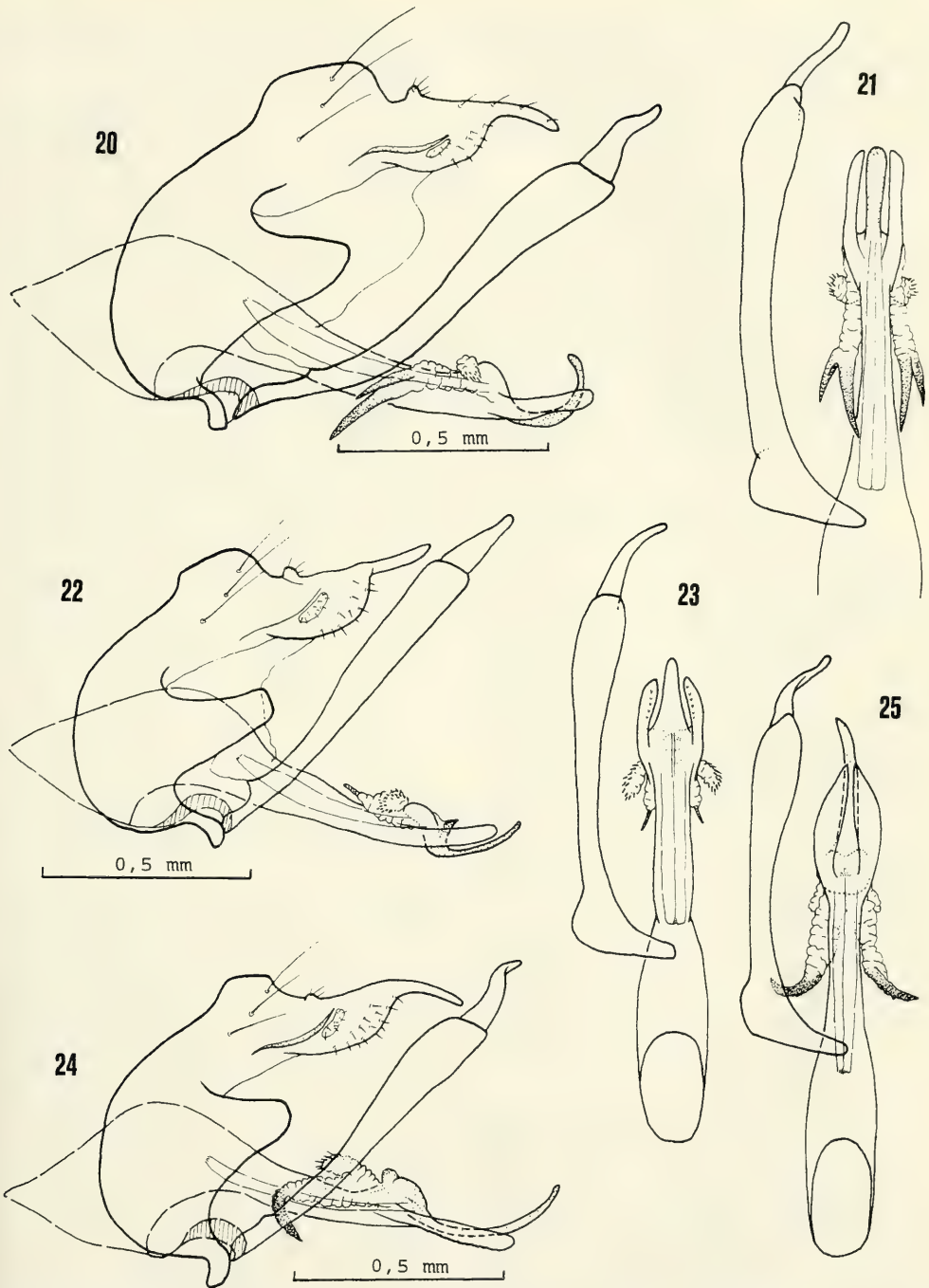
Male genitalia (figs. 17-19): Segment 10 with slender apical appendages and a pair of small dorsal processes. Apical segment of inferior appendages slender and ending with a seta. Base of phallosome broad, apical portion membranous dorsally and with two spines. Ventral tongue of phallosomal sclerites enlarged and hook-like apically, not reaching tip of phallosome. Dorsolateral membrane with broad appendages and a short spine.

Etymology. – The new species is named in honour of Hans Malicky, who discovered and described a great deal of the caddisfly fauna of Sumatra.

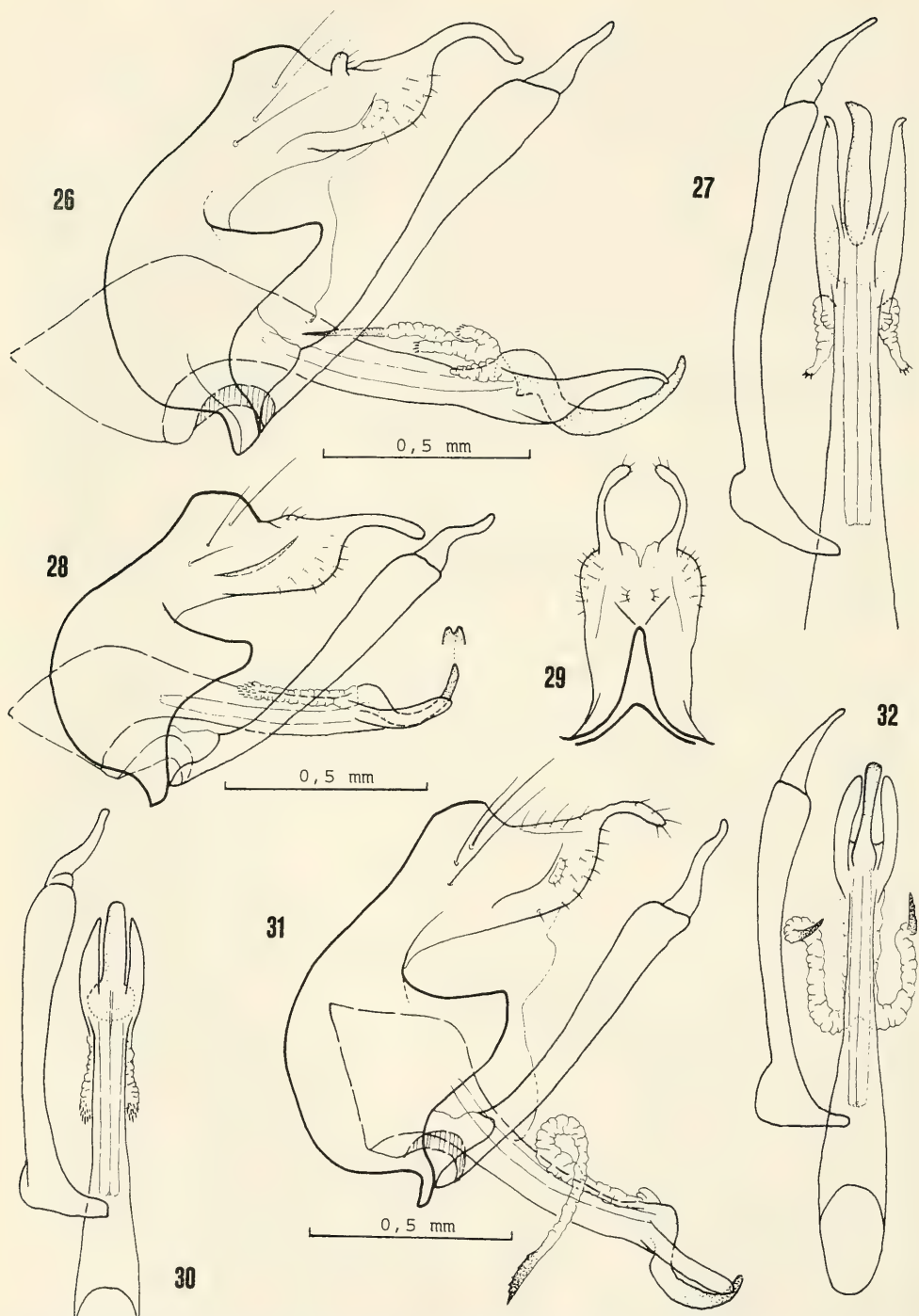


Figs. 12-19. Male genitalia of *Hydropsyche* spp. – 12-13, *H. taiwanensis* sp. n., 12, lateral, 13, ventral; 14-16, *H. initiana* sp. n., 14, lateral, 15, ventral, 16, tip of phallosome, dorsal; 17-19, *H. malickyi* sp. n., 17, lateral, 18, ventral, 19, tip of phallosome, dorsal.





Figs. 20-25. Male genitalia of *Hydropsyche* spp. – 20-21, *H. ambonensis* sp. n., 20, lateral, 21, ventral; 22-23, *H. seramensis* sp. n., 22, lateral, 23, ventral; 24-25, *H. palawanensis* sp. n., 24, lateral, 25, ventral.



Figs. 26-32. Male genitalia of *Hydropsycha* spp. – 26-27, *H. gemellata* sp. n., 26, lateral, 27, ventral; 28-30, *H. salki* sp. n., 28, lateral, 29, dorsal, 30, ventral; 31-32, *H. sirimauna* sp. n., 31, lateral, 32, ventral.

Remarks. – The species is related to *H. javanica*. The main differences are exhibited by the long phalotheca and the shape of the phallotremal tongue.

***Hydropsyche ambonensis* sp. n.**  
(figs. 20-21)

Type material. – Holotype ♂ (in alcohol), Indonesia, Ambon, Gunung Sirimau, 500m, 23.vii.1995, leg. S. Naumann, in MNHB. – Paratypes: 1 ♂, same data as holotype; 3 ♂, Indonesia, Ambon, Katalai, 470m, 26.vii.1995, leg. S. Naumann.

Description. – External characters: As in *H. germanorum* sp. n., wing length 8 mm.

Male genitalia (figs. 20-21): Short apical appendages and short dorsal processes on segment 10. Harpago of inferior appendages much smaller than copopodit, without peculiarities. Tip of phalotheca trifold. Tongue of phallotremal sclerites strongly curved and sclerotized. Dorsolateral membrane with two pairs of appendages, the smaller with minute spines apically, the longer ending with a large, bifurcate spur.

Remarks. – The new species is a close relative of *H. seramensis* sp. n. They differ in the form of the 10th segment and in the structure of the phallic apparatus.

***Hydropsyche seramensis* sp. n.**  
(figs. 22-23)

Type material. – Holotype ♂ (in alcohol), Indonesia, Seram, Piljana, Tule, 26.2.1995, leg. P. Salk, in MNHB. – Paratypes: 1 ♂, 1 ♀, same data as holotype.

Description. – External characters as in *H. germanorum* sp. n. Length of forewing 7.5 mm (♂)-8 mm (♀).

Male genitalia (fig. 22-23): Apical appendages of segment 10 straight, dorsal processes small. Second segment of inferior appendages short and simple. Phallotremal tongue longer than lateral tips of phalotheca, angulate at its base and with a small lateral teeth. Dorsolateral membrane with 2 pairs of appendages, the smaller with minute spines and the longer with an apical spur.

Remarks. – *H. seramensis* sp. n. is related to the preceding species. The form of the phallotremal tongue is unique within the group.

***Hydropsyche palawanensis* sp. n.**  
(figs. 24-25)

Type material. – Holotype ♂ (in alcohol), Philippines, Palawan, Puerto Princesa, Irawan river, 22.ii.1996, leg. J. Petersen, in MNHB. – Paratypes:

8 ♂, 9 ♀, same data as holotype (2 ♂ in coll. Malicky); 2 ♂, 1 ♀ (pinned), same locality, 24.-29.xi.1965, leg. D. Davis, in National Museum of Natural History, Washington (NMNH); 1 ♂ (pinned), Philippines, Palawan, Litso, Amoyan Ck., 57 km N Puerto Princesa, 10.XII.1965, in NMNH.

Description. – External characters as in *H. germanorum* sp. n. Length of forewing 7-8 mm.

Male genitalia (figs. 24-25): Apical segment of inferior appendages slender and bent. Phallotremal tongue very long and slender, protruding the lateral sides of phalothecal tip with half of its length. Dorsolateral membrane with 2 pairs of appendages, the smaller with minute spines and the longer with a bent and serrate spur.

Remarks. – The new species is a close relative of *H. mindorensis* and *H. cebuensis*. The main differences can be found in the structures of the phalotheca.

***Hydropsyche gemellata* sp. n.**  
(figs. 26-27)

Type material. – Holotype ♂ (in alcohol), Indonesia, Sulawesi Selatan, Puncal Palopo, Tanah Toraja, 1300m, 19.viii.1995, leg. S. Naumann, in MNHB. – Paratypes: 2 ♂, same data as holotype.

Description. – External characters as in *H. germanorum* sp. n. Length of forewing 9 mm.

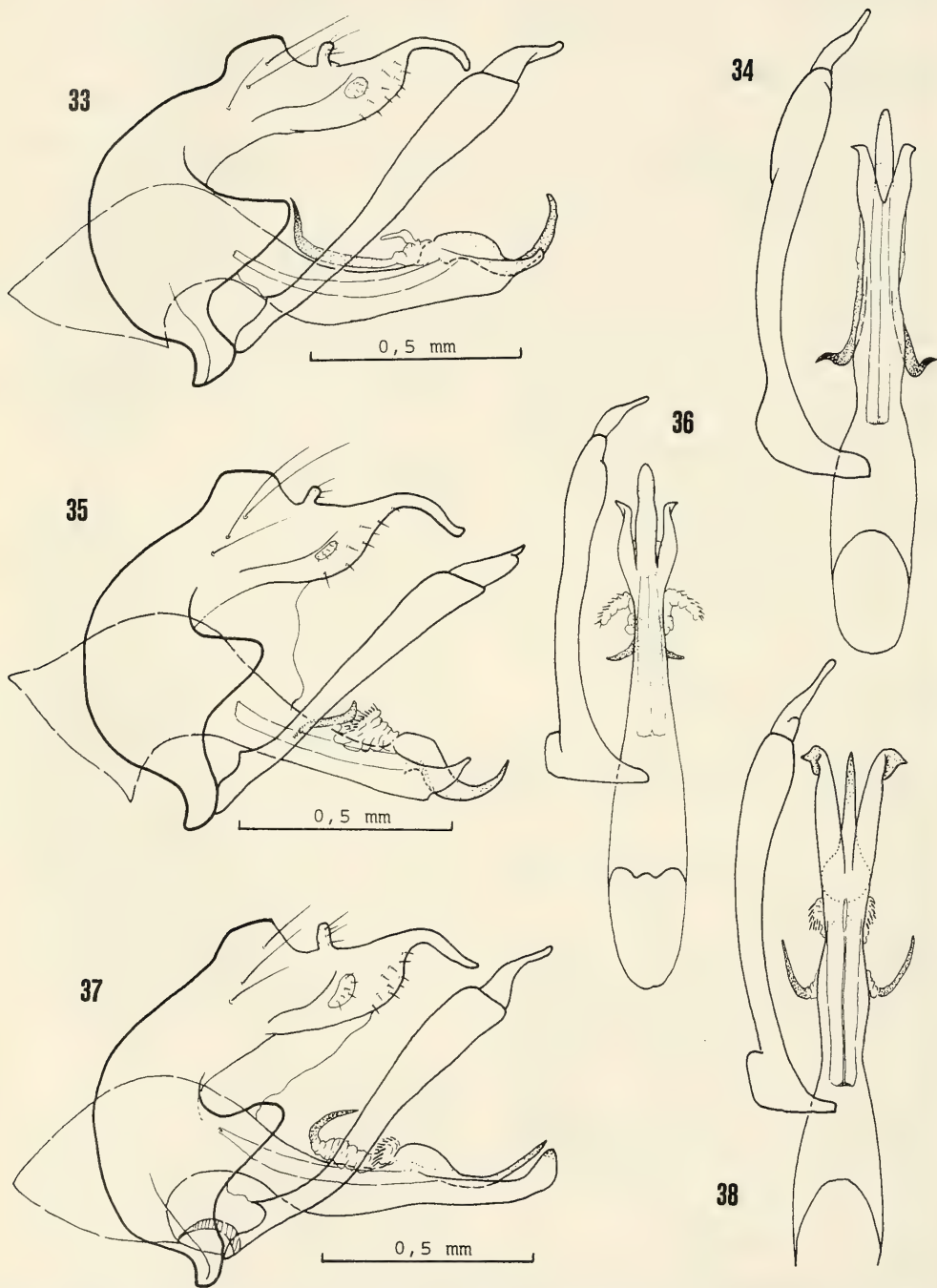
Male genitalia (figs. 26-27): Apical appendages of segment 10 bent downwards. Second segment of inferior appendages simple, with an acute tip. Phallotremal tongue longer than the lateral sides of phalothecal tip, which are characteristically curved upwards. Dorsolateral membrane with 3 pairs of appendages, the longer with a long spur apically, the two shorter ones with minute spines.

Remarks. – The nearest relative is obviously *H. hamifera* from the same island. In comparison with the figures of the type of *H. hamifera* in Neboiss (1996: 7) the species differs in the structure of the phalotheca.

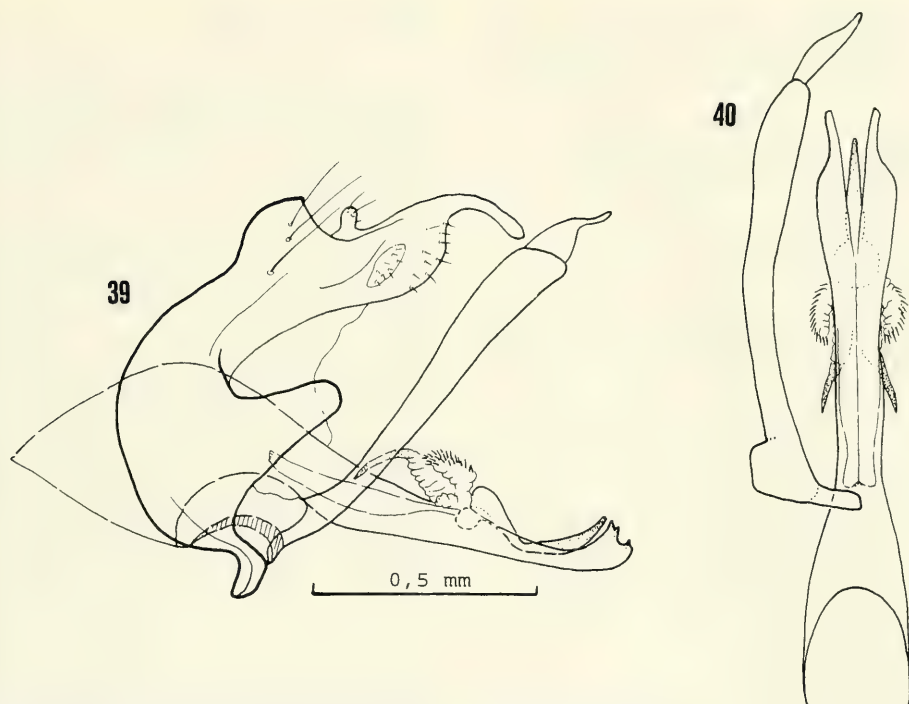
***Hydropsyche salki* sp. n.**  
(figs. 28-30)

Type material. – Holotype ♂ (in alcohol), Indonesia, Seram, Piljana, 25.2.1994, leg. P. Salk, in MNHB. – Paratypes: 2 ♀, same data as holotype; 3 ♂, Indonesia, Sulawesi Selatan, Puncak, 1000m, 22.ii.1994, leg. P. Salk; 47 ♂, 3 ♀, Indonesia, Bacan Island, Mt. Sibela, 5-8.ii.1996, leg. V. Siniaev (2 ♂ in coll. Malicky); 3 ♂, 3 ♀, Indonesia, Halmahera, Mt. Talagaramu, 15 km SE Baru, 600m, 22-31.i.1996, leg. V. Siniaev.





Figs. 33-38. Male genitalia of *Hydropsyche* spp. – 33-34, *H. suppleta* sp. n., 33, lateral, 34, ventral; 35-36, *H. naumanni* sp. n., 35, lateral, 36, ventral; 37-38, *H. sulana* sp. n., 37, lateral, 38, ventral.



Figs. 39-40. Male genitalia of *Hydropsyche bacanensis* sp. n. – 39, lateral, 40, ventral.

Description. – External characters as in *H. germanorum* sp. n. Length of forewing 8-10 mm.

Male genitalia (figs. 28-30): Segment 9 with a distinct carina. Dorsal processes of segment 10 very small or lacking. Apical segment of inferior appendages sinuate. Phallotremal tongue broad, with a bifid tip. Dorsolateral membrane with one pair of long appendages, apically armed with minute spines.

**Eymology.** – The species is dedicated to Peter Salk, who collected this species during his voyage in Indonesia and donated the material to the MNHB.

**Remarks.** – The species is related to *H. sirimauna* sp. n. The dorsolateral appendages of the phallotheca and the second joint of the inferior appendages are differently shaped.

***Hydropsyche sirimauna* sp. n.**  
(figs. 31-32)

**Type material.** – Holotype ♂ (in alcohol), Indonesia, Ambon, Gunung Sirimau, 500m, 23.vii.1995, leg. S. Naumann, in MNHB. – Paratypes: 5♂, Indonesia, Seram, Piljana, 600m, 26.ii.1994, leg. P. Salk.

**Description.** – External characters as in *H. germanorum* sp. n. Length of forewing 7.5 mm.

Male genitalia (figs. 31-31): Dorsal processes on segment 10 lacking. Apical segment of inferior appendages sinuate in lateral view. Phallotheca slightly bent upwards. Phallotremal tongue strongly sclerotized, as long as the phallotheca. Dorsolateral membrane with a pair of very long appendages, ending with a sclerotized and serrate tip.

**Remarks.** – *H. sirimauna* sp. n. is related with the preceding species. Both occur sympatrically on Seram.

***Hydropsyche suppleta* sp. n.**  
(figs. 33-34)

**Type material.** – Holotype ♂ (in alcohol), Indonesia, Ambon, Katalai, 470m, 26.vii.1995, leg. S. Naumann, in MNHB. – Paratypes: 1♂, same data as holotype; 2♂, Indonesia, Ambon, 200m, 24.ii.1994, leg. P. Salk; 1♂, Indonesia, Seram, Piljana, Tule, 600m, 26.2.1994, leg. P. Salk.

**Description.** – External characters as in *H. germanorum* sp. n. Length of forewing 8 mm.

Male genitalia (figs. 33-34): Segment 10 with both dorsal and apical appendages. Phallotheca slightly sinuate. Freely protruding apicolateral sides of phal-

lothea reduced. Phallotremal sclerites large, as long as its tongue. Dorsolateral membrane with two short lobes, the lateral one with a long and distinctively bent spine.

Remarks. – The new species is a close relative of *H. naumannii* sp. n. from Sulawesi. They differ in the structure of the dorsolateral appendages.

***Hydropsyche naumannii* sp. n.**  
(figs. 35–36)

Type material. – Holotype ♂ (in alcohol), Indonesia, Sulawesi Tengah, Taripa, 700m, 26.8.1995, leg. S. Naumann, in MNHB. – Paratypes: 2♂, same data as holotype.

Description. – External characters as in *H. germanorum* sp. n. Length of forewing 8 mm.

Male genitalia (figs. 35–36): Segment 10 with both dorsal and apical appendages. Phallotheca straight. Freely protruding apicolateral sides of phallotheca reduced, directed dorsally. Phallotremal sclerites large. Dorsolateral membrane with two pairs of appendages, the longer with a bent spur, the smaller with minute spines on the tips.

Etymology. – The species is named in honour of Stefan Naumann, specialist on Emperor Moths (Lepidoptera, Saturniidae), who collected the species on Sulawesi and donated the material to the MNHB.

Remarks. – The species is closely related to *H. suppleta* sp. n. from Seram and Ambon. Both species can be separated easily by the different structure of the phallic apparatus.

***Hydropsyche sulana* sp. n.**  
(figs. 37–38)

Type material. – Holotype ♂ (in alcohol), Indonesia, Moluccas, Sula Islands, Sanana, 1 km W Wai-bau, 250m, 3.viii.1995, leg. S. Naumann, in MNHB. – Paratypes: 5♂, 2♀, same data as holotype.

Description. – External characters as in *H. germanorum* sp. n. Length of forewing 8–9 mm.

Male genitalia (figs. 37–38): Segment 10 with dorsal and apical appendages. Second segment of inferior appendages short and slender. Phallotheca slightly sinuate, apicolateral parts enlarged and bent outwardly. Phallotremal tongue reaching just the tip of the phallotheca. Dorsolateral membrane with two pairs of appendages, the longer with a terminal spur, the shorter covered with minute spines.

Remarks. – The new species is related to the next species, *H. bacanensis* sp. n.

***Hydropsyche bacanensis* sp. n.**  
(figs. 39–40)

Type material. – Holotype ♂ (in alcohol), Indonesia, Moluccas, Bacan, Mt. Sibela, 2.- 13.ii.1996, leg. V. Siniaev, in MNHB. – Paratypes: 2♂, same data as holotype.

Description. – External characters as in *H. germanorum* sp. n. Length of forewing 8.2 mm.

Male genitalia (figs. 39–40): Segment 9 with a well developed carina. Second segment of inferior appendages with broad base and slender apical half. Phallotheca with elongated apical parts, broad and serrate dorsally. Phallotremal tongue not reaching tip of phallotheca. Dorsolateral membrane with two pairs of appendages, the slightly longer with a terminal spur and the shorter with minute spines.

Remarks. – *H. bacanensis* sp. n. is a close relative to the preceding species, *H. sulana* sp. n. The morphological differences in the phallic apparatus are minor, but constantly expressed.

ACKNOWLEDGEMENTS

I would like to thank those, who have collected *Hydropsyche* material in the West Pacific Region and donated it to me and to the MNHB: Dr. Eddi Diel, Axel Kallies, Stefan Naumann, Jan Petersen, Peter Salk, Alexander Schintlmeister, Sheng-Horn Yen. The work was supported by a grant from the Deutsche Forschungsgemeinschaft (Me 1085/5-1).

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# DIE PUPPEN EINIGER MITTELEUROPÄISCHEN UND KANARISCHEN SCYTHRIDIDAE (LEPIDOPTERA, GELECHIOIDEA)

Patočka, J., 1998. Die Puppen einiger mitteleuropäischen und kanarischen Scythrididae (Lepidoptera, Gelechioidea). – Tijdschrift voor Entomologie 140 [1997]: 207-220, figs. 1-120. [ISSN 0040-7496]. Published 26 March 1998.

The pupae of the family Scythrididae and the Central European genus *Scythris* Hübner are characterized. A key is provided to 16 species from Central Europe and 2 from the Canary islands; these species are briefly described and some biological data are given.

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Key words. – Lepidoptera; Scythrididae; Pupae; Taxonomy; Key to species.

Die Puppen der Familie Scythrididae sind bisher sehr wenig bekannt. So erwähnt z. B. Mosher (1916) die Puppen zweier nordamerikanischer Arten und Bengtsson (1984) einer mittel- bzw. nordeuropäischen Art. In der vorliegenden Arbeit werden insgesamt 18 Arten behandelt: 16 mitteleuropäischen und 2 von den Kanarische Inseln. Die Puppenexuvien der letzteren erhielt der Autor von Dr Klimesch ohne eingehendere Angaben. In Mitteleuropa (als Mitteleuropa wird hier Deutschland, die Schweiz, Österreich die Tschechische Republik, Polen, die Slowakei und Ungarn begriffen) sind von dieser Familie bisher 59 Arten bekannt, welche erst in den zwei letzten Jahrzehnten eingehender untersucht, taxonomisch aufgeklärt und verlässlich bearbeitet wurden. Die europäischen Arten werden neuerdings von Bengtsson (1997) bearbeitet. Die Beziehungen der Familie Scythrididae zu anderen Familien der Oberfamilie Gelechioidea, hinsichtlich ihrer Puppenmorphologie, werden in Patočka (1997, im Druck) besprochen.

Die Bionomie und die Nahrungspflanzen der Raupen sind nur lückenhaft bekannt. Manche Arten leben an Moosen (Bryophyta), die Mehrheit aber an Kräutern aus den Familien Chenopodiaceae, Caryophyllaceae, Polygonaceae, Crassulaceae, Fabaceae, Cistaceae, Lamiaceae, Ericaceae, Onagraceae, Asteraceae u.a. Die Raupen leben einzeln oder zu mehreren in einem Gespinst bzw. Gespinstnest unter oder an ihren Nahrungspflanzen und halten sich oft in einer Gespinsthöhle auf. Dort findet gewöhnlich auch die Verpuppung in einem dichten, weichen Gespinst statt.

Viele Arten bevorzugen offene und warmtrockene, andere eher frische bis feuchte Standorte und mehrere sind Gebirgsbewohner.

Die hier erwähnten Arten gehören alle in die Gattung *Scythris* Hübner, 1825. Bengtsson (1997) unterscheidet noch weitere Gattungen, von denen für Mitteleuropa noch *Parascythris* Hannemann, 1960 und *Enolmis* Duponchel, 1845 in Betracht kommen. Von diesen Gattungen konnte der Autor keine Vertreter untersuchen.

## MATERIAL UND METHODE

Das untersuchte Material stammt aus der Sammlung des Verfassers zu der viele Fachkollegen Material beigetragen haben und ferner aus folgenden Museen: Museum für Naturkunde Berlin, Zoologische Staatssammlung München und Naturhistorisches Museum Wien.

Die Puppen bzw. ihre Exuvien wurden aus ihren Kokons herausgenommen und mit Hilfe eines Stereomikroskopes untersucht, gemessen, beschrieben und gezeichnet. Das hier benutzte System folgt im wesentlichen Bengtsson (1984, 1997), Huemer & Tarmann (1993) und Karsholt & Razowski (1996). Die Nomenklatur richtet sich außerdem nach einer Liste der paläarktischen Scythrididae (aus dem Jahr 1987) welche B. A. Bengtsson dem Autor liebenswürdigerweise zur Verfügung stellte. Die puppenmorphologische Terminologie (vgl. Abb. 1, 5, 6, 32) folgt Mosher (1916).



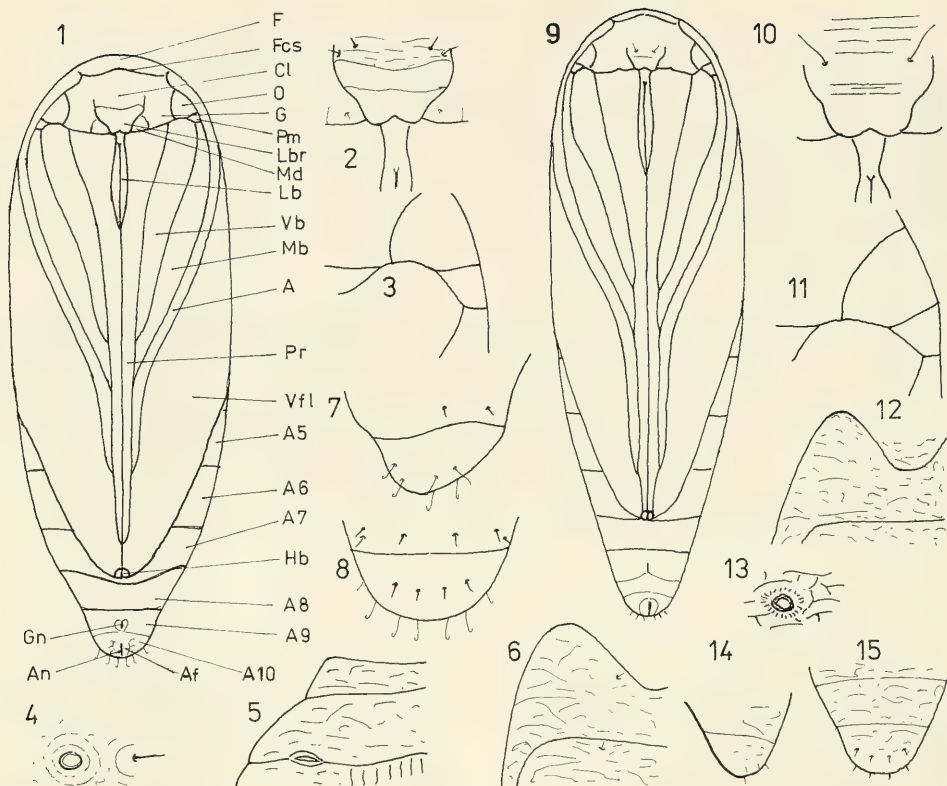


Abb. 1-15. – 1-8, *Scythris potentillella*; 9-15, *S. limbella*. – 1, 9 Habitusbild in Ventralansicht; 2, 10 Labrum und Umgebung; 3, 11 Palpus maxillaris und Umgebung; 4, 13 abdominales Spiraculum und Umgebung; 5, Vertex und Pronotum (linke Hälfte); 6, 12, Metanotum und Abdomenbasis (linke Hälfte); 7, 14, Abdomenende in Lateralansicht; 8, 15, Abdomenende in Dorsalansicht.

A = Antennae, A5 – A10 = 5.-10. Abdominalsegment, An = Analnaht, Af = Analfeld, Cl = Clypeus, F = Frons, Fcs = Frontoclypealsutur, G = Genae, Gn = Genitalnaht, Hb = Hinterbeine, Lb = Labium, Lbr = Labrum, Mb = Mittelbeine, Md = Mandibulae, Msn = Mesonotum, Mtn = Metanotum O = Oculi, Pcl = Postclypeus, Pm = Palpi maxillares, Pn = Pronotum, Pr = Proboscis, Vb = Vorderbeine, Vfl = Vorderflügel, Vx = Vertex.

#### CHARAKTERISTIK DER PUPPEN DER SCYTHRIDIDAE

Mumienpuppen (pupae obrectae), klein bis mittelklein, etwa 4-9 mm lang, mittelschlank (Abb. 16) bis mäßig gedrungen (Abb. 1), in Ventralansicht spindel- oder keilförmig, im Frontalteil relativ breit und stumpf abgerundet. Färbung braun (rot-, ocker- oder gelbbraun). Skulptur oft mittelfein bis mittelgrob. Meist findet man unregelmäßige Runzelung oder Netz- bzw. Zellskulptur. Manchmal ist die Skulptur dunkler als ihre Umgebung. Am Abdomen gibt es zuweilen auch Punktgrübchen (Abb. 50). Borsten – auch am Abdomen – oft klein bis mittelklein (Abb. 15, 88), seltener größer (Abb.21) oder nicht unterscheidbar (Abb. 27, 58). Nicht selten kommen auch Sekundarborsten (Abb. 112, 115) vor.

Frontoclypealsutur deutlich (Abb. 1). Labrum mit

steileren oder schrägeren Seiten, kaudal abgestumpft oder abgerundet und kaudal manchmal gewölbt (Abb. 96) häufiger aber tief manchmal spitz ausgeschnitten (Abb.2, 30, 43, 96). Labium mit Palpi labiales gut entwickelt (Abb. 1, 2). Manchmal ist die Basis des Labiums begrenzt undeutlich (Abb. 43, 48) oder sein Basalteil von den Palpi labiales abgetrennt (Abb. 59, 60). Palpi maxillares meist vorhanden und relativ klein (Abb. 18, 24, 31), selten nicht unterscheidbar (Abb. 59, 61). Vorderschenkel (die sich sonst zwischen Proboscis und Vorderbeinen befinden) dagegen immer verdeckt (Abb. 1). Antennae nicht selten kürzer als die Vorderflügel (Abb. 1, 59), aneinander angrenzend (Abb. 42, 47, 77) oder voneinander isoliert (Abb. 1, 53). Proboscis oft lang (Abb. 28, 53), manchmal aber auch relativ kurz (Abb. 42).

Vorderbeine kürzer (Abb. 1), seltener länger als die

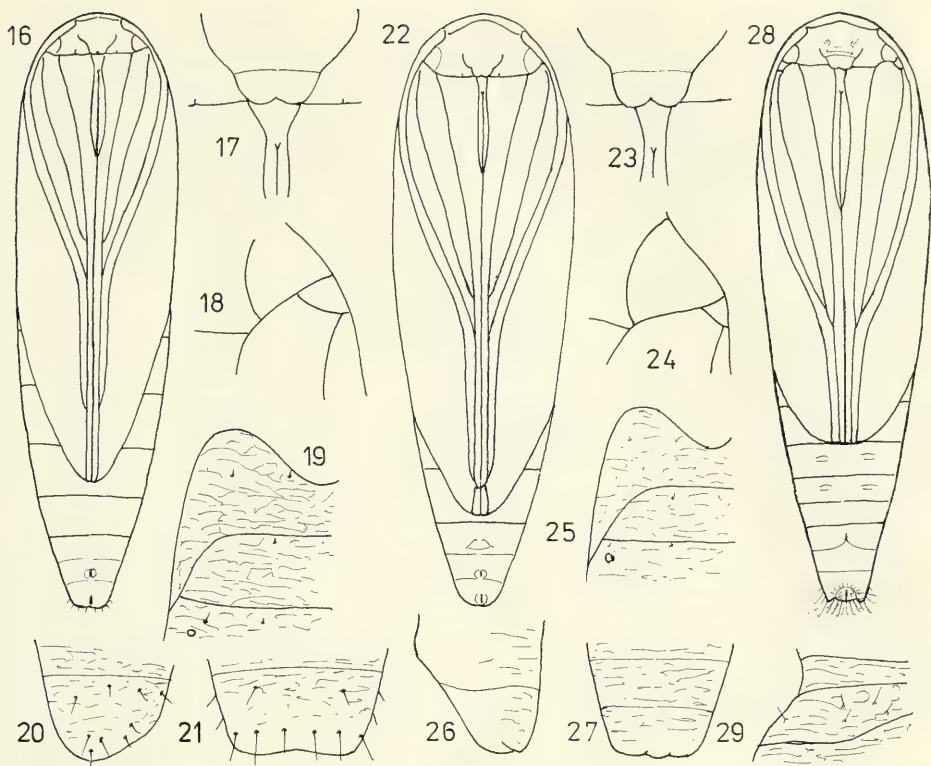


Abb. 16-29. – 16-21, *Scythris knockella*; 22-27, *S. paullella*; 28-29, *S. clavella*. – 16, 22, 28, Habitusbild in Ventralansicht; 17, 23, Labrum und Umgebung; 18, 24, Palpi maxillares und Umgebung; 19, 25, Metanotum und Abdomenbasis (linke Hälfte); 20, 26, Abdomenende in Lateralansicht; 21, 27, Abdomenende in Dorsalansicht; 29, Vertex und Pronotum (linke Hälfte).

Mittelbeine (Abb. 28, 107). Hinterbeine verdeckt (Abb. 28, 47) oder sichtbar, klein (Abb. 1) bzw. größer (Abb. 22) und selten frontal keilartig verjüngt (Abb. 77). Vorderflügel voneinander isoliert (Abb. 9, 28, 77) oder länger bzw. kürzer aneinander angrenzend (Abb. 1, 47, 65). Abdomen der Exuvie in Ventralansicht zum Kaudalrand des 4. (Abb. 28, 107) bis 8. oder Basis des 9. Segmentes (Abb. 59) verdeckt.

Pronotum meist länger und breiter als Vertex (Abb. 5). Thorakales Spiraculum spaltförmig (Abb. 5). Metanotum gewöhnlich breit und mitteltief ausgeschnitten und seine Frontallappen mittelbreit und abgerundet (Abb. 6, 67). Hinterflügel meist nur bis  $1/5-3/4$  des 2., selten zur Basis des 3. Abdominalsegmentes sichtbar (Abb. 32, 56, 112). Abdominale Spiracula manchmal etwas erhaben (Abb. 39, 113). Kremaster nicht entwickelt. Abdomenende spitzer (Abb. 65), oder stumpf abgerundet (Abb. 115), abgestumpft (Abb. 58) oder etwas konkav (Abb. 21), zuweilen mit Höckern oder Lappen an den Seiten (Abb. 28, 52, 76), selten stumpf zugespitzt (Abb. 82).

## Gattung *Scythris* Hübner, 1825

Mit der Charakteristik der Familie.

### Bestimmungstabelle der Arten

1. Enden der Hinterbeine sichtbar (Abb. 1, 22, 77) ..... 2
  - Enden der Hinterbeine verdeckt (Abb. 16, 28, 42) ..... 7
2. Enden der Hinterbeine lang und frontal keilartig verjüngt. Antennae berühren sich miteinander (Abb. 77) ..... *S. fuscoarena*
  - Enden der Hinterbeine mittellang bis kurz und frontal nicht keilartig. Antennae voneinander isoliert (Abb. 1, 22, 35) ..... 3
3. Antennae wesentlich kürzer als die Proboscis. Enden der Hinterbeine klein und kurz (Abb. 1, 9) ..... 4
  - Antennae nur etwas kürzer oder gleichlang, zuweilen auch länger als die Proboscis. Enden der Hinterbeine mittellang und länger als breit (Abb. 22, 35, 116) ..... 5

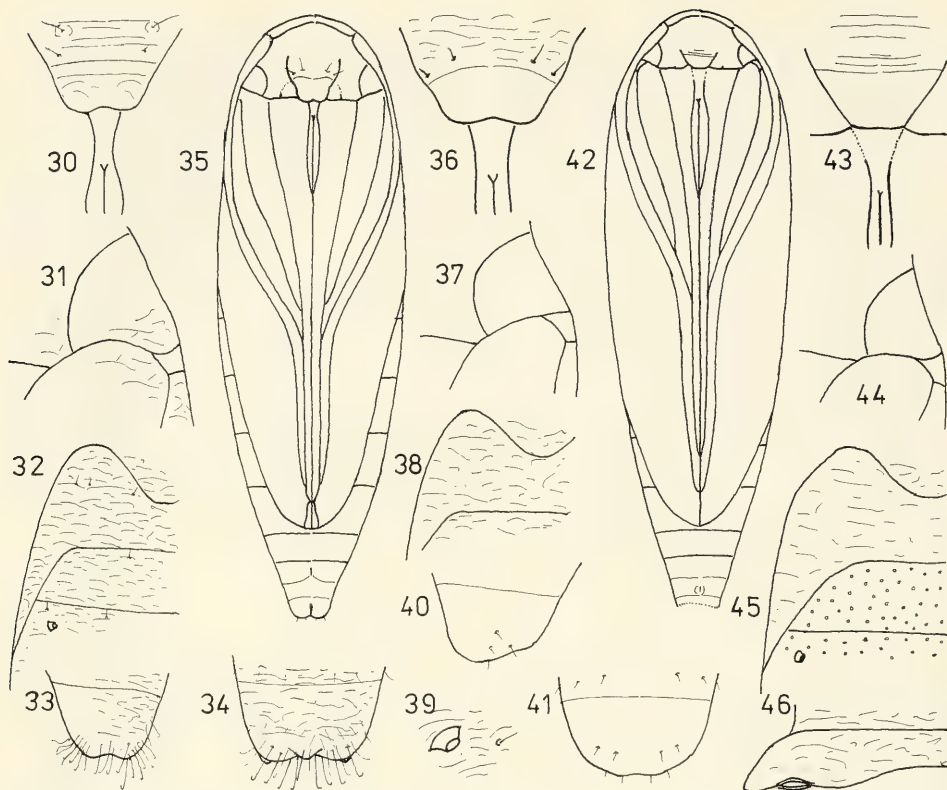


Abb. 30-46. – 30-34, *Scythris clavella*; 35-41, *S. palustris*; 42-46, *S. inspersella*. – 30, 36, 43, Labrum und Umgebung; 31, 38, 44, Palpus maxillaris und Umgebung; 32, 38, 45, Metanotum und Abdomenbasis (linke Hälfte); 33, 40, Abdomenende in Lateralansicht; 34, 41, Abdomenende in Dorsalansicht; 35, 42, Habitusbild in Ventralansicht; 39, Abdominales Spiraculum und Umgebung; 46 Pronotum (linke Hälfte). As = abdominales Spiraculum, Hfl = Hinterflügel, Mtn = Metanotum.

4. Grenze Proboscis/Antennae und Proboscis/Vorderflügel etwa gleichlang. Vorderflügel grenzen aneinander an. Puppe in Ventralansicht vor dem Abdomenende plötzlich verjüngt (Abb. 1) .....  
.....*S. potentillella*
- Grenze Proboscis/Antennae viel länger als Proboscis/Vorderflügel. Vorderflügel voneinander isoliert. Abdomenende verjüngt sich allmählich (Abb. 9) .....*S. limbella*
5. Antennae etwas länger als die Proboscis (Abb. 116). Grenze Palpi maxillares/Mittelbeine relativ lang (Abb. 118) .....*S. fallacella*
- Antennae etwas kürzer als die Proboscis (Abb. 22, 35). Grenze Palpi maxillares/Mittelbeine kurz (Abb. 24, 37) .....6
6. Clypeus mit deutlichen Borsten (Abb. 35, 36). Abdomen vor seinem Ende plötzlich verjüngt mit etwas konkaven Seiten (Abb. 35) .....*S. palustris*
- Borsten am Clypeus nicht unterscheidbar (Abb. 23). Abdomenende allmählich verjüngt und seine Seiten nicht konkav (Abb. 22) .....*S. paullella*
7. Proboscis, Antennae und Vorderflügel beinahe gleichlang (Abb. 28, 95, 107). Borsten am Abdomenende hakenartig (Abb. 100) und meist relativ lang und schlank (Abb. 34, 115) .....8
- Proboscis, Antennae und Vorderflügel nicht gleichlang (Abb. 16, 42, 47, 59). Wenn nur die Antennae etwas kürzer als die Proboscis und Vorderflügel (und oft auch sonst), sind die Borsten am Abdomenende kurz, nicht hakenartig (Abb. 71, 83, 88) oder nicht unterscheidbar (Abb. 58) .....10
8. Abdomen der Exuvie ventral bis zum 4. Segment verdeckt (Abb. 28, 107). Labrum kaudal deutlich ausgeschnitten (Abb. 30, 109) .....9
- Abdomen der Exuvie ventral bis zum kaudalteil des 6. Segmentes verdeckt (Abb. 95). Labrum am Ende abgerundet, nicht ausgeschnitten (Abb. 96) (Kanarische Inseln) .....*S. boseanella*
9. Abdomenende etwas zwei- oder dreilappig (Abb. 28, 33, 34). Bei der weiblichen Puppe die Vorderbeine länger als die Mittelbeine und Antennae mit Proboscis gleichlang (Abb. 28) .....*S. clavella*



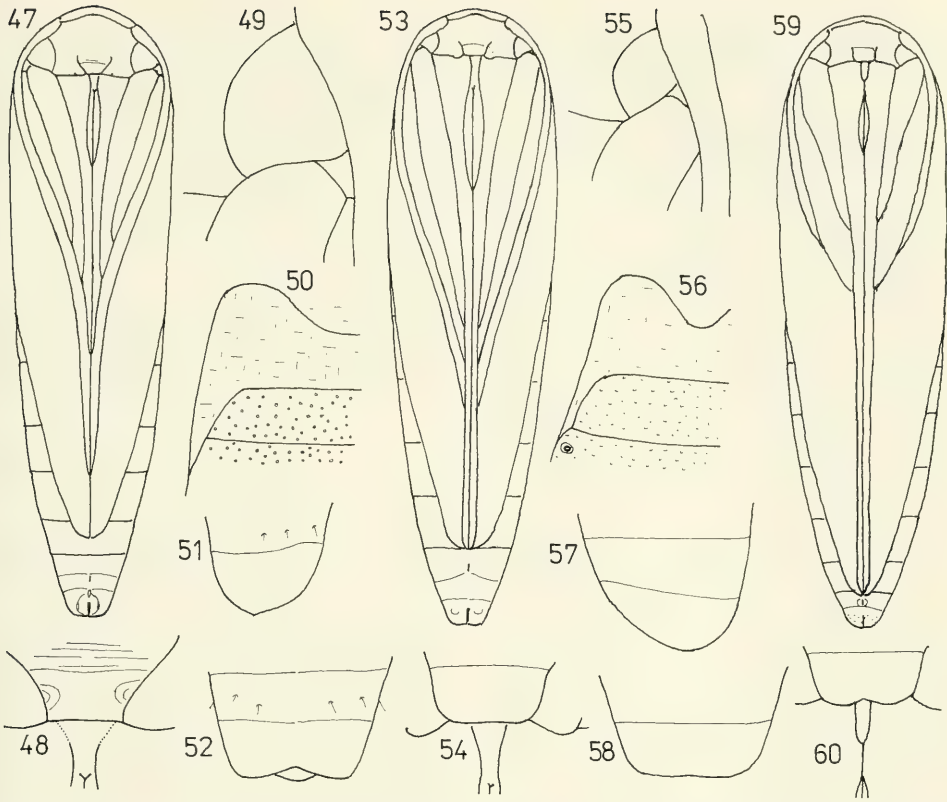


Abb. 47-60. — 47-52, *Scythris noricella*; 53-58, *S. siccella*; 54, 60, *S. braschiella*. — 47, 53, 59, Habitusbild in Ventralansicht; 48, 54, 60, Labrum und Umgebung; 49, 55, Palpus maxillaris und Umgebung; 50, 56, Metanotum und Abdomenbasis (linke Hälfte); 51, 57, Abdomenende in Lateralansicht; 52, 58, Abdomenende in Dorsalansicht.

- Abdomenende abgerundet (Abb. 107, 108, 114, 115). Bei der weiblichen Puppe die Vorderbeine kürzer als die Mittelbeine und Antennae als die Proboscis (Abb. 108) ..... *S. seliniella*
- 10. Mittelbeine kürzer als die Vorderbeine (Abb. 42, 47). Abdomen dorsal mit Grübchenskulptur (Abb. 45, 50) ..... 11
- Mittelbeine länger als die Vorderbeine (Abb. 53, 65). Abdomen dorsal mit Runzel- bzw. Netzskulptur (Abb. 86, 92), selten mit kaum angedeuteten Grübchen (Abb. 56) ..... 12
- 11. Antennae grenzen aneinander etwa so lang wie die Vorderflügel an. Proboscis relativ lang (Abb. 42) ..... *S. inspersella*
- Antennae grenzen aneinander viel länger als die Vorderflügel an. Proboscis relativ kurz (Abb. 47) ..... *S. noricella*
- 12. Antennae kürzer als die Mittelbeine (Abb. 59). Palpi maxillares nicht unterscheidbar (Abb. 61) .. *S. braschiella*
- Antennae länger als die Mittelbeine (Abb. 65, 71). Palpi maxillares unterscheidbar (Abb. 68, 74) ..... 13
- 13. Grenze Antennae/Proboscis kürzer als Proboscis/Vorderflügel (Abb. 53, 101) ..... 14
- Grenze Antennae/Proboscis länger als Proboscis/Vorderflügel (Abb. 83, 89) ..... 15
- 14. Labrum ziemlich tief und spitz ausgeschnitten (Abb. 102). Palpi maxillares relativ groß (Abb. 103). Grenze Mittelbeine/Proboscis viel kürzer als die Antennae/Proboscis (Abb. 101) (Kanarische Inseln) ..... *S. klimeschi*
- Labrum seicht und abgerundet ausgeschnitten oder fast gerade (Abb. 54). Palpi maxillares klein (Abb. 55). Grenze Mittelbeine/Proboscis wenig kürzer als Antennae/Proboscis (Abb. 53) ..... *S. siccella*
- 15. Grenze Antennae/Proboscis kaum oder bis etwa 2× länger als Proboscis/Vorderflügel (Abb. 16, 89) ..... 16
- Grenze Antennae/Proboscis mehr als 4× länger als Proboscis/Vorderflügel (Abb. 65, 83) ..... 17

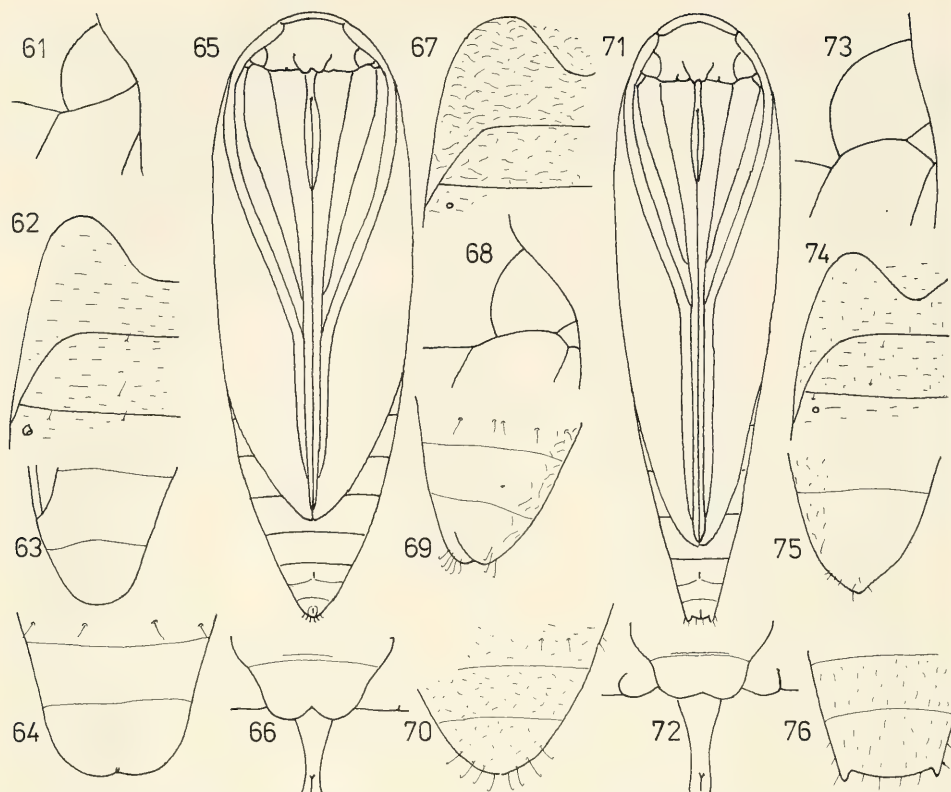


Abb. 61-76. – 61-64, *Scythris braschiella*; 65-70, *S. crassiuscula*; 71-76, *S. dissimilella*. – 61, 68, 73, Palpus maxillaris, bzw. Oculus und Umgebung; 62, 67, 74, Metanotum und Abdomenbasis (linke Hälfte); 63, 69, 75, Abdomenende in Lateralansicht; 64, 70, 76, Abdomenende in Dorsalansicht; 65, 71, Habitusbild in Ventralansicht; 66, 72, Labrum und Umgebung.

16. Vorderflügel grenzen aneinander an. Abdomenende spitzer abgerundet (Abb. 89). Labrum seicht und abgerundet ausgeschnitten (Abb. 90) .....  
 ..... *S. bengtssoni*  
 – Vorderflügel voneinander isoliert. Abdomenende eher stumpf (Abb. 16). Labrum spitz ausgeschnitten (Abb. 17) ..... *S. knochella*  
 17. Abdomenende in Ventralansicht mit je einem Seitenlappen. Proboscis vor dem Endeil etwas verschmälert (Abb. 71) ..... *S. dissimilella*  
 – Abdomenende in Ventralansicht ohne Seitenlappen. Proboscis vor dem Endeil nicht verschmälert (Abb. 65, 83) ..... 18  
 18. Vorderflügel grenzen kurz aneinander an. Abdomenende eher spitz (Abb. 65). Labrum tief und spitz ausgeschnitten (Abb. 66) .....  
 ..... *S. crassiuscula*  
 – Vorderflügel voneinander isoliert. Abdomenende eher stumpf (Abb. 83). Labrum seicht ausgeschnitten (Abb. 84). ..... *S. hungaricella*

***Scythris potentillella* (Zeller, 1847)**  
 (Abb. 1-8)

Untersuchtes Material. – 1 Männchen, Deutschland.

Beschreibung. – Puppe 5,4×2 mm, relativ gedrun-gen, Abdomen zwischen dem 8.-9. Segment plötzlich verjüngt. Färbung dunkel goldbraun, Exuvie orange-braun, schwach glänzend. Skulptur überall deutlich, unregelmäßig runzelig-zellartig. Borsten steif, auch am Clypeus deutlich, am Abdomenende hakenartig. Labrum kaudal tief ausgeschnitten. Labium basal deutlich begrenzt und wenig erweitert. Palpi maxillares ziemlich groß und viereckig. Grenze Palpi maxillares/Oculi kaum länger als Antennae/Palpi maxillares und Vorderbeine/Genae kurz, nicht länger als Palpi maxillares/Mittelbeine. Grenze Mittelbeine/Proboscis fast halb so lang wie Proboscis/Antennae. Vorderflügel grenzen kurz, aber deutlich aneinander an. Hinterbeine unterscheidbar, recht klein. 7. Abdominalsegment der Exuvie ventral fast verdeckt und

seine Grenze mit dem 8. Segment geschwungen. Pronotum viel länger als Vertex, Mesonotum frontal längsgerippt. Thorakales Spiraculum kurz spaltförmig. Metanotum recht breit abgerundet und tief ausgeschnitten. Abdominale Spiracula breit elliptisch, wenig erhaben, durch konzentrische Ringelung gesäumt. Analfeld mit je einem Eindruck.

Perianalhähchen vorhanden. Abdomenende abgerundet, in Lateralansicht im Dorsalumschnitt abgeschrägt und in Dorsalansicht mit zwei Querreihen von Borsten.

Lebensweise. – Raupe an *Acetosella vulgaris* (Koch) Fourr. (= *Rumex acetosella*) in einer Gespinsthöhle entlang des Stengels. Diese Art bevorzugt sandige Standorte, auch im Gebirge.

***Scythris limbella*** (Fabricius, 1775)  
(Abb. 9-15)

Untersuchtes Material. – 1 Weibchen, Deutschland.

Beschreibung. – Puppe 6,3×2,0 mm, mäßig gedrunken. Abdomen am 8.-9. Segment nicht auffallend verjüngt. Färbung rotbraun, Exuvie hell rotgelbbraun, etwas glänzend. Skulptur stark und unregelmäßig runzelig-zellartig. Borsten auch am Clypeus deutlich. Morphologisch *S. potentillella* ähnlich, aber die Grenze Antennae/Proboscis viel länger als Mittelbeine/Proboscis oder Proboscis/Vorderflügel. Vorderflügel voneinander isoliert. Enden der Hinterbeine sichtbar und winzig. Labrum stark ausgeschnitten. Grenze Palpi maxillares/Mittelbeine relativ kürzer als bei *S. potentillella*. Abdomen der Exuvie ventral bis zum Kaudalrand des 7. Segmentes verdeckt. Ausschnitt des Metanotums relativ schmaler. Abdominale Spiracula dunkel, kreisförmig und kaum erhaben. Abdomenende in Lateralansicht regelmäßig abgerundet, in Dorsalansicht mit zwei Querreihen steifer Borsten.

Lebensweise. – Raupe gruppenweise in einem Gespinst an Blättern und Blüten von *Chenopodium* und *Atriplex* spp. Ruderal- und öde Standorte.

***Scythris knochella*** (Fabricius, 1794)  
(Abb. 16-21)

Untersuchtes Material. – 1 Männchen, 1 Weibchen, Deutschland.

Beschreibung. – Puppe 5,1-5,4×1,4-1,6 mm, rotbraun, Exuvie heller. Skulptur deutlich, unregelmäßig runzelig, Borsten ebenfalls deutlich, aber am Kopf nicht unterscheidbar. Labrum kaudal stark ausgeschnitten und Labium an der Basis deutlicher erweitert als bei den vorhergehenden Arten. Palpi maxillares eher dreieckig, ihre Grenze mit den Mittelbeinen kurz. Grenze Genae/Vorderbeine ebenfalls kurz. Vor-

derbeine und die Grenze Mittelbeine/Proboscis auch nicht lang. Grenze Proboscis /Antennae etwa 2× länger als Proboscis/Vorderflügel. Hinterbeine nicht sichtbar. Vorderflügel voneinander isoliert. Abdomen der Exuvie ventral bis etwa zu  $\frac{3}{4}$  des 7. Segmentes verdeckt. Ausschnitt des Metanotums mit eher schrägen Seiten. Abdominale Spiracula kreisrund und wenig erhaben. Abdomenende stumpf oder etwas ausgeschnitten und mit starken Borsten versehen.

Lebensweise. – Noch nicht ausreichend bekannt. Als Nahrungspflanze der Raupe wird *Cerastium*, aber auch *Thymus* spp. angegeben. Trockene offene Standorte werden bevorzugt.

***Scythris paullella*** (Herrich-Schäffer, 1855)  
(Abb. 22-27)

Untersuchtes Material. – 1 Männchen, 3 Weibchen, Deutschland.

Beschreibung. – Puppe 4,2-5,3×1,3-1,6 mm, hellbraun, Exuvie bleich bräunlichgelb. Skulptur unregelmäßig runzelig bis zellartig. Borsten am Kopf kaum unterscheidbar und auch am Abdomen klein. Labrum ähnlich wie bei den vorherigen Arten, kaudal ausgeschnitten. Labium relativ klein, an der Basis mäßig verbreitert. Palpi maxillares klein, fast dreieckig. Ihre Grenze mit den Mittelbeinen und auch Vorderbeine/Genae sehr kurz. Proboscis lang und berührt die relativ großen Enden der Hinterbeine. Seine Grenze mit den Mittelbeinen und Vorderflügeln kurz, mit den Antennae sehr lang. Vorderflügel voneinander isoliert. Abdomen der Exuvie ventral fast bis zum Kaudalrand des 7. Segmentes verdeckt. Pronotum relativ kurz, aber deutlich länger als Vertex. Thorakales Spiraculum spaltförmig und schmal. Metanotum etwa bis zu  $\frac{1}{2}$  seiner Länge breit ausgeschnitten. Abdominale Spiracula klein und deutlich erhaben. Abdomenende stumpf, in Lateralansicht sein Ventralumschnitt abgeschrägt. Die männliche Puppe mit einer Erhabenheit ventral am 8. Abdominalsegment, diese fehlt bei der weiblichen.

Lebensweise. – Raupe an Moosen (*Polytrichum* spp.) in feinem Gespinstnest. Lokal an felsigen, buschigen und ziemlich sonnigen Standorten ebenso an alkalischen, wie auch sauren Substrat.

***Scythris clavella*** (Zeller, 1855)  
(Abb. 28-34)

Untersuchtes Material. – 1 Weibchen, Böhmen (Bohemia).

Beschreibung. – Puppe 6,5×1,9 mm, rotbraun, Exuvie heller. Skulptur relativ grob, scharf dunkel, netzartig. Borsten deutlich, auch am Clypeus unter-



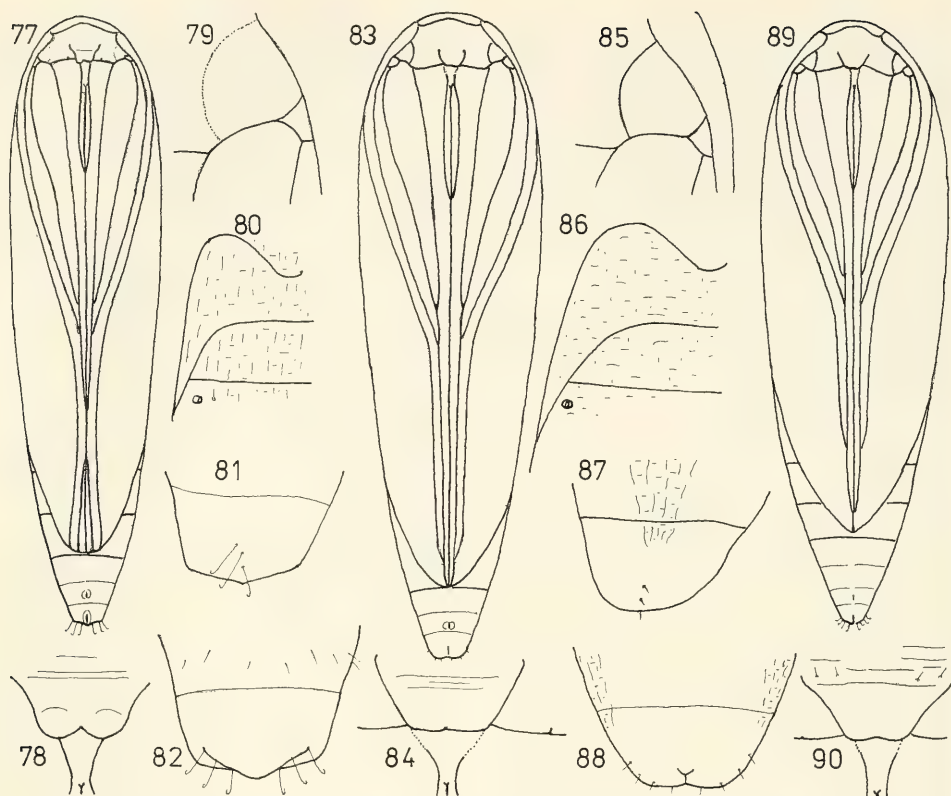


Abb. 77-90. – 77-82, *S. fuscoarena*; 83-88, *S. hungaricella*; 89-90, *S. bentgssoni*. – 77, 83, 89, Habitusbild in Ventralansicht; 78, 84, 90, Labrum und Umgebung; 79, 85, Palpus maxillaris und Umgebung; 80, 86, Metanotum und Abdomenbasis (linke Hälfte); 81, 87, Abdomenenende in Lateralansicht; 82, 88, Abdomenenende in Dorsalansicht.

scheidbar, am Pronotum deutlicher, am Abdomen mittelklein. Häkchen am Abdomenenende und ebenfalls die Perianalhäkchen lang und schlank hakenförmig. Auch zahlreiche überzählige (sekundäre) Borsten vorhanden. Clypeus rauh skulptiert und etwas höckerig. Labrum abgerundet trapezförmig mit schrägen Seiten und am Kaudalende mittelseicht ausgeschnitten. Labium lang und an der Basis mäßig erweitert. Palpi maxillares mittelgroß, trapezförmig, an die Mittelbeine ziemlich lang angrenzend. Auch die Grenze Genae/Vorderbeine länger als bei *S. paullella*. Mittelbeine etwas kürzer als die Vorderbeine. Proboscis grenzt an die Antennae lang an. Vorderflügel, Antennae und Proboscis etwa gleichlang. Vorderflügel voneinander isoliert. Abdomen der Exuvie in Ventralansicht nur bis zum Kaudalrand des 4. Segmentes verdeckt. Am 5. und 6. Segment sind Spuren der Abdominalbeine unterscheidbar. Pronotum relativ breit mit geschwungenem Kaudalrand. Thorakale Spiracula schmal und unauffällig. Metanotum mittelbreit und etwa zu  $\frac{1}{2}$  seiner Länge ausgeschnitten. Hinterflügel bis zur Basis des 3. Abdominalsegmentes

sichtbar. Abdominale Spiracula etwas erhaben. Abdomenenende – auch in Lateralansicht – etwas eckig bzw. lappig und im Mittelteil konkav, in Dorsalansicht mit einem kleinen Kaudalhöcker. Analfeld und seine Umgebung ziemlich rauh.

Lebensweise. – Nahrungspflanze nach Bengtsson (1997) ist *Helianthemum nummularium* (L.) Miller. Die hier beschriebene Puppe wurde von eingetragene *Teucrium chamaedris* L. erzogen (persönliche Mitteilung von Dr. Vávra, Prag). Die Imago bevorzugt warmtrockene Standorte.

#### *Scythris seliniella* (Zeller, 1839) (Abb. 107-115)

Untersuchtes Material. – 1 Männchen, 1 Weibchen, Polen.

Beschreibung. – Puppe 5,6-6,2×1,6-1,8 mm rot-, bei dem Weibchen eher ockerbraun, Exuvie heller. Skulptur relativ grob, scharf und dunkel runzelig-netzartig. Borsten deutlich (auch am Clypeus unterschei-

dbar), fein, aus dunkleren Pinnacula entspringend. Auch zahlreiche sekundäre Borsten vorhanden. Am 10. Abdominalsegment sind die End- und Perianalborsten recht zahlreich, lang und schlank, hakenförmig. Morphologisch *S. clavella* ähnlich. Abdomenende bei beiden Geschlechtern abgerundet und nicht lappig. Bei dem Männchen Antennae, Proboscis und Vorderflügel gleichlang und Mittelbeine kürzer als die Vorderbeine. Bei dem Weibchen Antennae etwas kürzer als die Proboscis und Vorderflügel; Vorderbeine kürzer als die Mittelbeine.

Lebensweise. – Raupe lebt nach der Mitteilung von T. Baran (Toruń) an Moosen (*Musci* spp.), aber auch an *Artemisia campestris* L. (T. Baran in Vorbereitung). Auch diese Art bevorzugt warmtrockene und sonnige Standorte.

### *Scythris palustris* (Zeller, 1855)

(Abb. 35-41)

Untersuchtes Material. – 1 Männchen, 1 Weibchen, Deutschland.

Beschreibung. – Puppe 4,2-4,6×1,2-1,4 mm, ockerbraun, Exuvie hell bräunlich ockergelb und mäßig glänzend. Skulptur scharf und unregelmäßig runzelig. Borsten klein und steif, auch am Clypeus deutlich. Morphologisch *S. paullella* ähnlich. Abdomenende am 8. und 9. Segment auffallender verjüngt und dort in Ventralansicht sein Umriß etwas konkav. Palpi maxillares relativ etwas größer und ihre Grenze mit den Mittelbeinen länger. Grenze Oculi/Vorderbeine kürzer als bei *S. paullella*. 7. Abdominalsegment der Exuvie ventral praktisch bis zum Kaudalrand verdeckt. Abdomenende mehr abgerundet und in Lateralansicht sein Dorsalumriß abgeschrägt.

Lebensweise. – Raupe an Moos (*Rhytidiadelphus* sp.) in Gestrüpp. An feuchten und offenen Standorten.

### *Scythris inspersella* (Hübner, 1817)

(Abb. 42-46)

Untersuchtes Material. – 1 Männchen, Norwegen (Abdomenende beschädigt).

Beschreibung. – Puppe 5,5×1,8 mm, rotbraun, Exuvie hell rötlich braun. Skulptur fein: Am Kopf und Thorax feine quere und wirre Runzeln, am 1.-8. Abdominalsegment winzige Punktgrübchen. Borsten sehr klein. Labrum trapezförmig und kaudal nicht ausgeschnitten. Postclypeus stärker quengerunzelt. Labium mittelgroß, seine Basis erweitert und unscharf begrenzt. Palpi maxillares klein, viereckig, seine Grenze mit den Mittelbeinen ziemlich lang. Grenze Genae/Vorderbeine kurz. Vorderbeine deut-

lich länger als die Mittelbeine, Antennae länger als die Proboscis, aber kürzer als die Vorderflügel. Antennae und Vorderflügel grenzen etwa gleichlang aneinander an. Hinterbeine nicht sichtbar. 7. Abdominalsegment der Exuvie ventral bis auf einen schmalen Kaudalstreifen verdeckt. Pronotum mittelschmal, sein Kaudalrand geschwungen. Thorakales Spiraculum spaltförmig, dunkel. Metanotum nur etwa zu 1/3 seiner Länge, breit und abgerundet ausgeschnitten. Sichtbarer Teil der Hinterflügel überragt wenig die Höhe der Spiracula am 2. Abdominalsegment. Abdominale Spiracula mäßig erhaben. Abdomen zum Ende allmählich verjüngt.

Lebensweise. – Raupe an *Chamerion angustifolium* (L.) Holub, oft gruppenweise, in versponnenen Triebspitzen. Verpuppungskokon weißlich. An frischen Waldlichtungen, um Waldwege usw.

### *Scythris noricella* (Zeller, 1843)

(Abb. 47-52)

Untersuchtes Material. – 5 Männchen, 5 Weibchen, Böhmen (Bohemia).

Beschreibung. – Puppe 7-8,5×2,3-2,6 mm, rotbraun (Exuvie heller), mäßig glänzend. Skulptur mittelfein bis mitteltrob, am Kopf und Thorax unregelmäßig gerunzelt, am 1.-8. Abdominalsegment scharfe und dichte Punktgrübchen. Borsten winzig, am 8. und 9. Abdominalsegment etwas größer. Labrum trapezförmig, seine Basis, wie auch Postclypeus stark gefurcht. Labium mittelklein, basal etwas erweitert und unscharf begrenzt. Palpi maxillares mittelklein, fast dreieckig, ihre Grenze mit den Mittelbeinen sehr kurz. Grenze Genae/Vorderbeine relativ länger. Vorderbeine deutlich länger als die Mittelbeine. Proboscis relativ kurz. Antennae grenzen aneinander deutlich länger als die Vorderflügel und als Antennae an die Proboscis an. 7. Abdominalsegment der Exuvie ventral nur etwa zur Mitte seiner Länge verdeckt. Pronotum mittellang, thorakales Spiraculum auffällig und groß. Metanotum kaum zu 1/2 seiner Länge, breit und abgerundet ausgeschnitten. Hinterflügel etwa zu 1/2 des 2. Abdominalsegmentes sichtbar. Abdominale Spiracula deutlich erhaben. 8-10. Abdominalsegment unscharf voneinander abgegrenzt. Abdomenende abgestumpft, nur in Lateralansicht abgerundet. Analfeld mit Eindrücken. Borsten am Abdomenende kaum unterscheidbar.

Lebensweise. – Raupe an *Chamerion angustifolium* (L.) Holub, oft gruppenweise, in versponnenen Triebspitzen. Verpuppungskokon weißlich. Mehr in Gebirge, an ähnlichen Standorten wie *S. inspersella*.

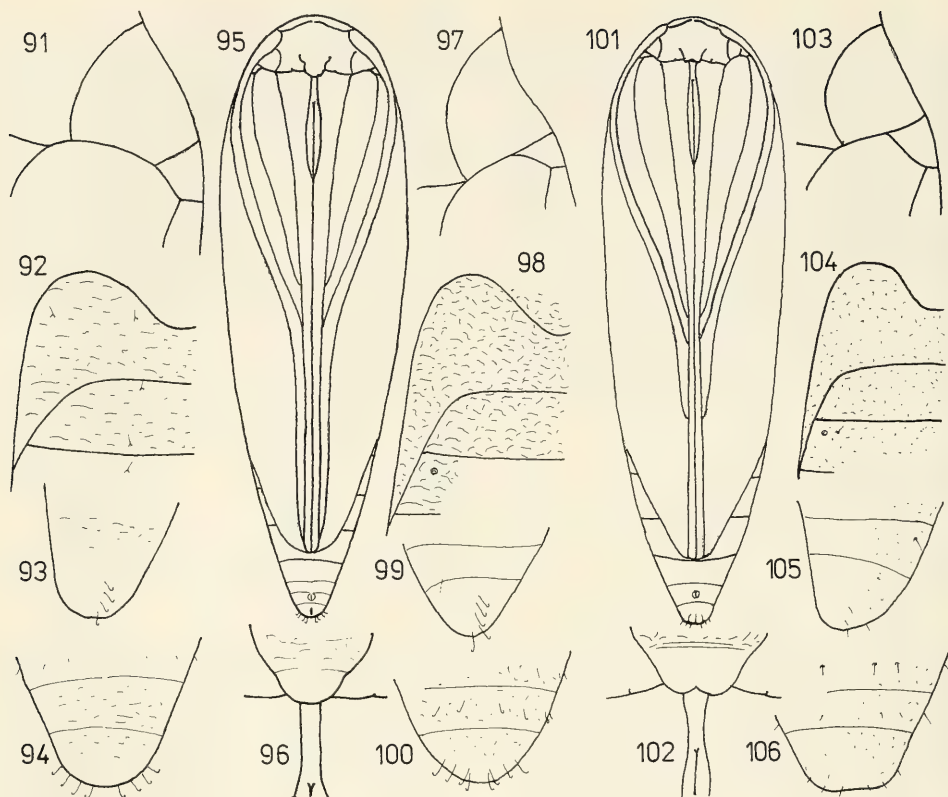


Abb. 91-106. – 91-94, *S. bengtsoni*; 95-100, *S. boseanella*; 101-106, *S. klimeschi*. – 91, 97, 103, Palpus maxillaris und Umgebung; 92, 98, 104, Metanotum und Abdomenbasis (linke Hälfte), 93, 99, 105, Abdomenende in Lateralansicht; 94, 100, 106, Abdomenende in Dorsalansicht; 95, 101, Habitusbild in Ventralansicht; 96, 102, Labrum und Umgebung.

***Scythris siccella* (Zeller, 1839)**

(Abb. 53-58)

Untersuchtes Material. – 1 Weibchen, Deutschland.

Beschreibung. – Puppe 4,3×1,2 mm, relativ schlank. Färbung rötlich ockerbraun, Exuvie heller. Skulptur fein gerunzelt, Abdomen dorsal papillos skulpturiert. Borsten winzig, am Kopf und Abdomenende nicht unterscheidbar. Labrum auffallend breit, kaudal ein wenig ausgeschnitten. Mandibulae deutlich. Labium groß, an der Basis scharf begrenzt und wenig verbreitert. Palpi maxillares klein und dreieckig, unscharf begrenzt. Vorderbeine grenzen lang an die Basis der Antennae an. Oculi schwach abgegrenzt. Vorderbeine kürzer als die Mittelbeine, diese kürzer als die Antennae, alle aber viel kürzer als die Proboscis, diese gleichlang wie die Vorderflügel. Abdomen der Exuvie ventral bis zum Kaudalrand des 7. Segmentes verdeckt. Thorakale Spiracula wenig auffällig, spaltförmig. Metanotum etwa zu ½ seiner Länge stumpf ausgeschnitten, Ausschnitt mit schrä-

gen Seiten. Hinterflügel nur bis zur Basis des I. Abdominalsegmentes sichtbar. Abdominale Spiracula fast kreisrund und wenig erhaben. Abdomenende stumpf, in Lateralansicht stumpf abgerundet. Analnaht lang, Analfeld etwas uneben.

Lebensweise. – Raupe in einer Gespinnströhre an der Basis der niedrig wachsenden Kräuter (wahrscheinlich polyphag) an offenen und sonnigen Stellen.

***Scythris braschiella* (Hofmann, 1897)**

(Abb. 59-64)

Untersuchtes Material: 3 Männchen, 3 Weibchen, Deutschland.

Beschreibung. – Puppe 4,2-4,6×1,0-1,4 mm, mittelschlank, dorsoventral abgeflacht. Färbung braun, Exuvie bleich gelbbraun. Skulptur aus feinen Runzeln. Borsten klein, am Kopf und Abdomenende nicht unterscheidbar. Labrum breit und abgerundet, kaudal spitz ausgeschnitten. Labium klein, Basis der



Palpi labiales verdeckt. Palpi maxillares nicht unterscheidbar, auch Oculi kaum abgegrenzt. Vorder-, Mittelbeine und Antennae kurz. Proboscis so lang wie die Vorderflügel und sehr lang an diese angrenzend. Abdomen der Exuvie ventral bis zur Basis des 9. Segmentes verdeckt. Metanotum zu  $\frac{1}{2}$  seiner Länge, breit und abgerundet ausgeschnitten. Hinterflügel überragen nur kurz den Kaudalrand des 1. Abdominalsegmentes. Abdomenende stumpf, in Lateralansicht spitzer abgerundet. Analfeld quergerunzelt.

Lebensweise. – Raupe lebt an *Armeria maritima* Miller (Willd.). An sandigen Standorten.

***Scythris crassiuscula*** (Herrich-Schäffer, 1855)  
(Abb. 65-70)

Untersuchtes Material. – 1 Weibchen, Mähren (Moravia).

Beschreibung. – Puppe 4,1×1,4 mm, eher gedrun-gen. Färbung rotbraun, Exuvie rötlich braungelb, glänzend. Skulptur mittelmäßig, runzelig zellartig, ihre Elemente etwas dunkler als die Umgebung. Borsten deutlich, am Kopf nicht unterscheidbar, am Abdomenende fein hakenartig; auch die Perianalhäkchen deutlich. Labrum mit konvergierenden Seiten, am Ende tief und spitz ausgeschnitten. Labium relativ lang, Basis erweitert. Palpi maxillares mittelmäßig, viereckig, ihre Grenze mit den Mittelbeinen deutlich. Grenze Genae/Vorderbeine mittelmäßig. Vorderbeine kürzer als die Mittelbeine, Proboscis länger als die Antennae. Vorderflügel grenzen kurz aneinander, Proboscis lang an die Antennae an. Abdomen der Exuvie ventral bis zu  $\frac{3}{4}$  des 6. Segmentes verdeckt. Metanotum zu  $\frac{1}{2}$  seiner Länge, mittelmäßig und abgerundet ausgeschnitten. Abdominale Spiracula klein und wenig erhaben. Abdomenende relativ spitz.

Lebensweise. – Raupe an *Helianthemum* spp. Trockenwarme, offene Standorte; mit Vorliebe am Kalksubstrat.

***Scythris dissimilella*** (Herrich-Schäffer, 1855)  
(Abb. 71-76)

Untersuchtes Material. – 3 Weibchen, Böhmen (Bohemia).

Beschreibung. – Puppe eher schlank, 6,1-6,3×1,6-1,8 mm. Färbung orangebraun, Exuvie heller. Skulptur mittelmäßig, scharf und unregelmäßig runzelig. Borsten winzig und auch am Abdomenende klein, am Kopf nicht unterscheidbar. Labrum mit relativ steilen Seiten, kaudal mitteltief und spitz ausgeschnitten. Mandibulae relativ deutlich. Labium mittelmäßig, frontal mäßig erweitert, an der Basis unscharf begrenzt. Palpi maxillares klein und dreieckig, die Mittelbeine fast nur punktiert berührend. Auch ihre Gren-

ze mit Oculi relativ kurz, ähnlich wie die Grenze Genae/Vorderbeine. Vorderbeine kürzer als die Mittelbeine. Proboscis deutlich länger als die Antennae und fast so lang wie die Vorderflügel, diese ganz kurz aneinander angrenzend. Grenze Proboscis/Mittelbeine und Proboscis/Vorderflügel annähernd gleichlang. Proboscis am Ende etwas erweitert zwischen den Enden der Antennae eher verschmälert. Abdomen der Exuvie ventral etwa zu  $\frac{2}{3}$  des 7. Segmentes verdeckt. Metanotum frontal bis  $\frac{1}{2}$  seiner Länge ausgeschnitten, Ausschnitt abgerundet mit schrägen Seiten. Hinterflügel bis kaudal der Höhe der Spiracula am 2. Abdominalsegment sichtbar. Abdominale Spiracula klein und wenig erhaben. Abdomenende in Ventral- und Dorsalansicht mit eckigen, kaudal gerichteten Seitenausläufern, in Lateralansicht ziemlich spitz.

Lebensweise. – Raupe an *Helianthemum* spp.; an ähnlichen Standorten wie die vorherige.

***Scythris fuscoaenea*** (Haworth, 1828)  
(Abb. 77-82)

Untersuchtes Material. – 1 Männchen, 1 Weibchen, Böhmen (Bohemia).

Beschreibung. – Puppe 5,9-6,3×1,4-1,6 mm, honigbraun, Exuvie heller. Skulptur mittelmäßig vorwiegend länglich, aber auch quer und unregelmäßig gerunzelt. Borsten klein. Labrum mittelmäßig, nahe der Basis mäßig eingeschnürt. Palpi maxillares klein und viereckig, ihre Grenze mit den Mittelbeinen kurz und die mit den Antennae am längsten. Die spitze Proboscis länger als die Mittelbeine. Antennae grenzen mittelmäßig aneinander an und sind etwa so lang wie die Vorderflügel. Enden der Hinterbeine groß und frontal keilförmig verjüngt. Abdomen der Exuvie ventral fast bis zum Kaudalrand des 7. Segmentes verdeckt. Pronotum relativ lang und hinten geschwungen begrenzt. Thorakales Spiraculum ziemlich auffällig, ihre Umgebung gerunzelt. Metanotum etwa zu  $\frac{1}{2}$  seiner Länge, ziemlich breit und abgerundet ausgeschnitten. Hinterflügel über  $\frac{1}{2}$  des 2. Abdominalsegmentes sichtbar. Abdominale Spiracula erhaben. Abdomenende stumpf zugespitzt mit deutlichen feinen Häkchen, in Lateral- ziemlich ähnlich wie in Dorsalansicht.

Lebensweise. – Raupe an *Helianthemum* spp. An trockenwarmen, offenen Standorten; mit Vorliebe am Kalksubstrat.

***Scythris hungaricella*** Rebel, 1917  
(Abb. 83-88)

Untersuchtes Material. – 1 Männchen, 1 Weibchen, Slowakei.

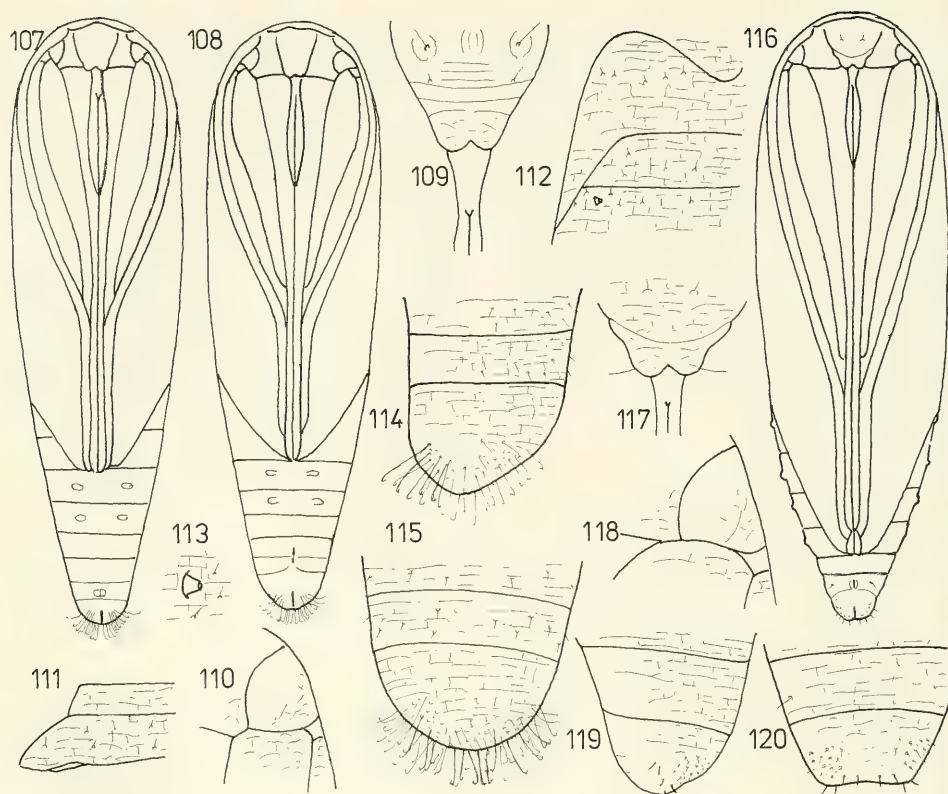


Abb. 107-120. – 107-115, *Scythris seliniella*; 116-120, *S. fallacella*. – 107, 108, 116, Habitusbild in Ventralansicht (107, 116 Männchen, 108, Weibchen); 109, 117, Labrum und Umgebung; 110, 118, Palpus maxillaris und Umgebung; 111, Vertex und Pronotum (linke Hälfte); 112, Metanotum und Abdomenbasis (linke Hälfte); 113, abdominales Spiraculum und Umgebung; 114, 119, Abdomenende in Lateralansicht; 115, 120, Abdomenende in Dorsalansicht.

Beschreibung. – Puppe 6,0-7,2×2,0-2,2 mm, mittelschlank, honigbraun, Exuvie heller. Skulptur mittelfein, unregelmäßig runzelig-zellartig. Borsten, auch am Abdomenende, winzig. Labrum trapezförmig, kaudal kaum ausgeschnitten. Labium mittelgroß, seine Basis stark erweitert und unscharf begrenzt. Palpi maxillares klein, denen bei der vorherigen Art ähnlich. Grenze Genae/Vorderbeine mittelkurz. Mittelbeine etwas länger als die Vorderbeine, Proboscis länger als die Antennae, ist am Ende zugespitzt und so lang wie die Vorderflügel. Abdomen der Exuvie ventral bis zum Kaudalrand des 7. Segmentes verdeckt. Pronotum mittellang, viel länger als Vertex. Thorakales Spiraculum kurz und spaltförmig, seine Umgebung gerunzelt. Metanotum etwa zu ½ seiner Länge ausgeschnitten, Ausschnitt abgerundet mit schrägen Seiten. Abdominale Spiracula deutlich, aber kaum erhaben. Abdomenende, auch in Lateralansicht, relativ breit abgerundet.

Lebensweise. – Raupe in einem Gespinnstnest an der Basis der Polster von *Thymus* spp. An trocken-

warmen und sonnigen Standorten. Substrat: junge, effusive Gesteine oder Kalkstein.

*Scythris bengtssoni* Patočka & Liška, 1989  
(Abb. 89-94)

Untersuchtes Material. – 1 Männchen, Slowakei.

Beschreibung. – Puppe 5,5×1,7 mm, mäßig gedrungen, rotbraun, Exuvie hell rötlich braun. Skulptur mittelfein, vorwiegend querrunzelig-zellartig, am Clypeus, Frons und Vertex stärker. Borsten klein, aber deutlich, auch am Clypeus unterscheidbar. Labrum trapezförmig, seine Seiten etwas geschwungen, kaudal ganz schwach konkav. Labium mittelgroß, an der Basis mäßig erweitert und unscharf begrenzt. Palpi maxillares mittelklein, ihre Grenze mit den Mittelbeinen relativ lang. Vorderbeine mäßig kürzer als die Mittelbeine, die spitze Proboscis auch kürzer als die Vorderflügel. Antennae wesentlich kürzer als die Proboscis. Vorderflügel grenzen kurz

aneinander an. Abdomen der Exuvie ventral zu mehr als  $\frac{2}{3}$  des 7. Segmentes verdeckt. Pronotum viel länger als Vertex, kaudal wenig geschwungen begrenzt. Thorakales Spiraculum kurz und dunkel. Metanotum etwa zu  $\frac{1}{2}$  seiner Länge, breit und abgerundet ausgeschnitten. Hinterflügel etwa zur Höhe der Spiracula des 2. Abdominalsegmentes sichtbar. Abdominale Spiracula deutlich erhaben und dunkel. Abdomenende ziemlich zugespitzt, kaudal abgestumpft und abgerundet (auch in Lateralansicht).

Lebensweise. – Raupe durch nächtliches Streifen gewonnen, fraß bis zur Verpuppung *Thymus* spp. (persönliche Mitteilung von Ing. Turčáni). An warmtrockenen, steppenartigen Standorten. Substrat: junge effusive Gesteine oder Kalkstein.

***Scythris fallacella*** (Schläger, 1847)  
(Abb. 116-120)

Untersuchtes Material. – 2 Männchen, 1 Weibchen, Deutschland.

Beschreibung. – Puppe 4,0-5,0×1,4-1,7 mm. Färbung rötlich braun, Exuvie heller, mäßig glänzend. Skulptur fein, unregelmäßig runzelig-netzartig. 10. Abdominalsegment lateral mit Mikrobörstchen an Papillen. Borsten, auch am Clypeus, deutlich, am Abdomenende steif. Labrum abgerundet mit steilen Seiten, kaudal spitz und tief ausgeschnitten. Labium mittelklein, an der Basis wenig erweitert und überall scharf begrenzt. Palpi maxillares mittelklein und viereckig, grenzen an die Mittelbeine relativ lang an. Grenze Genae/Vorderbeine ebenfalls relativ deutlich. Vorder- und die etwas längeren Hinterbeine ziemlich lang. Antennae und Proboscis fast so lang wie die Vorderflügel, die mittelkleinen Enden der Hinterbeine berührend. Antennae und Vorderflügel voneinander isoliert, Antennae grenzen an die Proboscis lang an. Abdomen der Exuvie ventral bis zum Kaudalrand des 7. Segmentes verdeckt. Pronotum breit, sein Kaudalrand geschwungen. Thorakales Spiraculum schmal und spaltförmig. Metanotum etwa zu  $\frac{1}{2}$  seiner Länge ausgeschnitten, dieser Ausschnitt abgerundet mit schrägen Seiten. Hinterflügel nur bis zur Basis des 2. Abdominalsegmentes sichtbar. Abdominale Spiracula deutlich erhaben. Abdomenende stumpf und kaudal etwas ausgeschnitten, in Lateralansicht sein Dorsalumriß geschwungen.

Lebensweise. – Raupe an *Helianthemum* spp. Diese Art bevorzugt offene felsige und sonnige Gebirgsstandorte am Kalksubstrat, manchmal aber auch in tieferen Lagen.

## Kanarische Arten

***Scythris boseanella*** Klimesch, 1986  
(Abb. 95-100)

Untersuchtes Material: 3 Männchen, 3 Weibchen. Kanarische Inseln.

Beschreibung. – Puppe 7,5-8,5×2,3-2,6 mm. Sie ist am Kaudalende relativ spitz abgerundet, rotbraun, Exuvie heller gefärbt. Skulptur mittelgrob runzelig-zellartig und dunkel. Borsten klein, am Kopf kaum unterscheidbar. Labrum kaudal gewölbt und abgerundet, hinten nicht ausgeschnitten. Labium mittelgroß, basal scharf begrenzt und nicht erweitert. Palpi maxillares klein und eckig, ihre Grenze mit den Mittelbeinen kurz. Grenze Genae/Vorderbeine meist punktiert. Mittelbeine länger als die Vorderbeine, beide kurz. Proboscis so lang wie die Vorderflügel und die Antennae nur wenig kürzer. Abdomen der Exuvie ventral fast zum Ende des 6. Segmentes verdeckt. Pronotum relativ breit, sein Kaudalrand geschwungen. Thorakales Spiraculum kurz spaltförmig. Metanotum zu  $\frac{1}{2}$  seiner Länge und abgerundet ausgeschnitten. Hinterflügel zur Basis des 3. Abdominalsegmentes sichtbar. Abdominale Spiracula kreisrund und wenig erhaben. Abdomenende mit Häkchen bewachsen.

***Scythris klimeschi*** Passerin d' Entrèves, 1986  
(Abb. 101-106)

Untersuchtes Material: 3 Männchen, 4 Weibchen. Kanarische Inseln.

Beschreibung. – Puppe 4,2-4,6×1,3-1,4 mm. Abdomenende mit etwas konkaven Seiten und relativ spitz abgerundet. Färbung honigbraun, Exuvie heller. Skulptur relativ fein, eher chagriniert als gerunzelt. Borsten recht fein, am Kopf kaum unterscheidbar. Labrum mit steilen Seiten, abgerundet, kaudal tief und spitz ausgeschnitten. Labium eher klein, Frontalteil scharf abgegrenzt und nur wenig erweitert. Palpi maxillares relativ groß, kurz an die Mittelbeine angrenzend. Grenze Genae/Vorderbeine sehr kurz. Mittelbeine etwas, Antennae viel länger als die Vorderbeine, aber kürzer als die Proboscis, welche mit den Vorderflügeln gleichlang ist. Abdomen der Exuvie ventral bis zum Kaudalrand des 7. Segmentes verdeckt. Pronotum relativ kurz, thorakales Spiraculum mittellang, spaltförmig. Metanotum etwa zu  $\frac{1}{2}$  seiner Länge ausgeschnitten. Dieser Ausschnitt stumpf abgerundet mit steilen Seiten. Frontallappen des Metanotums ebenfalls breit und stumpf abgerundet. Hinterflügel bis zur Basis des 3. Abdominalsegmentes sichtbar. Abdominale Spiracula klein und et-



was erhoben. Am Abdomenende sehr kleine Borsten.

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*CERATINA ZWAKHALSI* ET *C. VERHOEFFI*,  
DEUX NOUVELLES ESPECES DE LA RÉGION  
OUEST-PALÉARCTIQUE  
(HYMENOPTERA, APOIDEA, XYLOCOPINAE)

Terzo, M. & P. Rasmont, 1998. *Ceratina zwakhalsi* et *C. verhoeffi*, deux nouvelles espèces de la région ouest-paléarctique (Hymenoptera, Apoidea, Xylocopinae). – Tijdschrift voor Entomologie 140 [1997]: 221-236, figs. 1-58, tables 1-6. [ISSN 0040-7496]. Published 26 March 1998.

Two new species of small carpenter bees are described from the West Palearctic region: *Ceratina zwakhalsi* from South-East Turkey (compared with *C. acuta* Friese, 1896, *C. callosa* (Fabricius, 1794) and *C. chalybea* Chevrier, 1872) and *Ceratina verhoeffi* from Morocco (compared with *C. saundersi* Daly, 1983 and *C. maghrebensis* Daly, 1983). Distribution maps are given for all the treated species. *Ceratina saundersi* is recorded for the first time from Portugal, the Lampedusa island (South of Sicily), the Italian peninsula and Lybia. The occurrence of *C. saundersi* in Sardinia and Spain is confirmed.

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Key words. – Hymenoptera; Apoidea; Xylocopinae; *Ceratina*; systematics; new species; West-Palearctic; distribution maps.

À l'occasion de notre révision de la collection de M. Gijs van der Zanden (Eindhoven, Pays-Bas), deux nouvelles espèces de cératines de la région ouest-paléarctique ont été découvertes: *C. (Euceratina) verhoeffi* sp. n. et *C. (Euceratina) zwakhalsi* sp. n. Elles viennent s'ajouter à la liste des espèces de cératines ouest-paléarctiques connues notamment depuis les travaux de Friese (1896, 1901) et Daly (1983).

*C. zwakhalsi* est comparée ici à *C. acuta* Friese, 1896, *C. callosa* (Fabricius, 1794) et *C. chalybea* Chevrier, 1872 tandis que *C. verhoeffi* est comparée à *C. saundersi* Daly, 1983 et *C. maghrebensis* Daly, 1983. Les mesures utiles pour caractériser ces espèces sont décrites en détail par Daly (1973). Elles sont reprises aux figures 1, 2 et 3 et sont exprimées en centièmes de millimètres. Elles ont été mesurées notamment sur les holotypes mâles des nouvelles espèces. La longueur de l'aile est mesurée depuis l'apex de la plaque humérale jusqu'à l'apex de l'aile. La nomenclature des organes est inspirée de Bitsch & Leclercq (1993). Les individus, autres que les types, ayant servis à la réalisation des figures et des tableaux proviennent des localités suivantes: *C. acuta* ♂: Grèce,

Macedonia, péninsule de Sithonia; *C. acuta* ♀: Bulgarie, Blageovgrad, Sandanski; *C. callosa* ♂: Espagne, Teruel, Pozondon; *C. callosa* ♀: Espagne, Valencia, Loriguilla ; *C. chalybea* ♂: France, Haute Loire, St-Didier d'Allier; *C. chalybea* ♀: France, Alpes de Hautes Provence, Vachères; *C. maghrebensis* ♂: Maroc, Marrakech, Marrakech; *C. maghrebensis* ♀: Maroc, Aguerd el Had; *C. saundersi* ♂ et ♀: Espagne, Alicante, Moraira; *C. verhoeffi* ♀: Maroc, Marrakech, Ouirgane; *C. zwakhalsi* ♀: Turquie, Hakkari, Varagoz.

Les localisations des données citées sont renseignées en degrés-minutes Greenwich.

Le matériel typique, soit les deux mâles de *C. zwakhalsi* et de *C. verhoeffi*, provenant de la collection privée de Monsieur Ing. Gijs van der Zanden, appartient maintenant à la collection du Nationaal Natuurhistorisch Museum Leiden, Pays-Bas (RMNH, Dr C. van Achterberg). Le reste du matériel de ces deux espèces et celui des espèces qui leur sont comparées proviennent essentiellement des musées et collections suivants: Oberösterreich Landesmuseum Linz (OOLL, Mag. F. Gusenleitner), Ecole Nationale Supérieure

Tableau 1. *Ceratina* spp. Caractères cuticulaires et pelage.

	<i>C. callosa</i>	<i>C. chalybea</i>	<i>C. acuta</i>	<i>C. zwakhalsi</i>
<b>Coloration générale</b>	♂ - ♀: bleu métallique, y compris les sternites	♂ - ♀: bleu métallique, sternites noirs	♂ - ♀: bleu métallique, y compris les sternites	♂ - ♀: bleu métallique, y compris les sternites
<b>Labre</b>	♂: noir, parfois avec une petite marque centrale ivoire ♀: noir	♂: ivoire ♀: noir	♂: noir avec une petite marque centrale ivoire ♀: noir	♂: ivoire ♀: noir
<b>Clypeus</b>	♀: noir, avec parfois une petite marque centrale ivoire réduite; ponctation fine et présente sur tout le clypeus; environs 8 ponctuations de front derrière la suture clypeale postérieure	♀: comme <i>callosa</i> mais avec une marque ivoire plus grande	♀: noir, avec parfois une petite marque centrale ivoire; ponctuations de largeur égale à celles du reste de la face et bien délimitées; environs six ponctuations de front derrière la suture clypeale postérieure (fig. 25)	♀: noir, avec une marque ivoire centrale de petite taille, rarement absente; certaines ponctuations deux à trois fois plus grandes que celles du reste de la face, mal délimitées et éparées; environs cinq ponctuations de front derrière la suture clypeale postérieure (fig. 24)
<b>Carène hypostomienne</b>	♂ - ♀: étroite et très légèrement convexe (fig. 44)	♂ - ♀: étroite antérieurement, large et convexe postérieurement (fig. 45)	♂ - ♀: comme <i>zwakhalsi</i>	♂ - ♀: très étroite et droite sur toute sa longueur (fig. 46)
<b>Lobes pronotaux</b>	♂ - ♀: ivoire bordés ou non de noir	♂ - ♀: noirs ou ivoire bordés de noir	♂ - ♀: entièrement ivoire	♂ - ♀: entièrement ivoire
<b>Mesonotum</b>	♂ - ♀: partie dorsale éparsement et irrégulièrement ponctué, laissant de petites plages imponctuées ou des plages à plus grande densité de ponctuations; avec, entre les notauli et la ligne médiane, 2 à 4 ponctuations contigües ou très distantes	♂ - ♀: comme <i>callosa</i>	♂ - ♀: partie dorsale densément et régulièrement ponctué; avec, entre les deux notauli 8 à 10 ponctuations espacées par 1 fois le diamètre d'une ponctuation au plus (fig. 27)	♂ - ♀: partie dorsale éparsement et régulièrement ponctué; avec, entre les deux notauli 6 à 8 ponctuations espacées par plus de deux fois le diamètre d'une ponctuation (fig. 26)
<b>Fémur postérieur</b>	♂: pilosité ventrale de la moitié basale en forme de brosse courte de longueur constante (fig. 4)	♂: pilosité ventrale de la moitié basale en forme de brosse courte avec des soies deux fois plus longues au tier apical (fig. 5)	♂: pilosité ventrale de la moitié basale en forme de brosse longue (fig. 19)	♂: pilosité ventrale de la moitié basale en forme de brosse courte dont la longueur croît progressivement depuis la base du fémur jusqu'à sa mi-longueur (fig. 6)
<b>Tibia postérieur</b>	♂: pilosité ventrale plus longue à l'apex que la plus grande largeur du tibia (fig. 4); épine basitibiale située au quart de la longueur du tibia	♂: comme <i>callosa</i> (fig. 5)	♂: comme <i>callosa</i> (fig. 19)	♂: comme <i>callosa</i> (fig. 6)
<b>Sternite 6</b>	♂: marge postérieure avec deux larges lobes submédians tronqués à l'apex et dont la base interne porte un petit lobe secondaire dirigé vers l'avant (fig. 10)	♂: marge postérieure avec deux larges lobes submédians tronqués à l'apex et dont la base interne porte un petit lobe secondaire tronqué à l'apex et dirigé vers l'arrière (fig. 11)	♂: fort semblable à <i>zwakhalsi</i> (fig. 21)	♂: marge postérieure avec deux petits lobes submédians arrondis à l'apex et dont la base interne porte un petit lobe secondaire dirigé vers l'arrière (fig. 12)
<b>Carène du tergite 6</b>	♀: presque droite, étroite, avec une légère convexité à la base	♀: avec une convexité basale bien marquée, suivie d'une concavité jusqu'à l'apex acuminé	♀: comme <i>callosa</i>	♀: comme <i>chalybea</i> mais avec une concavité centrale et une convexité basale moins marquées
<b>Tergite 7</b>	♂: arrondi à l'apex, avec des marges latérales droites ou concaves (fig. 7)	♂: largement arrondi à l'apex, avec des marges latérales jamais concaves (fig. 8)	♂: pointu à émoussé à l'apex; en forme de triangle dont les marges latérales sont droites ou légèrement concaves (fig. 20)	♂: fortement pointu à l'apex, formant un angle aigu (fig. 9)
<b>Genitalia</b>	voir figures 13 et 16	voir figures 14 et 17	voir figures 22 et 23	voir figures 15 et 18



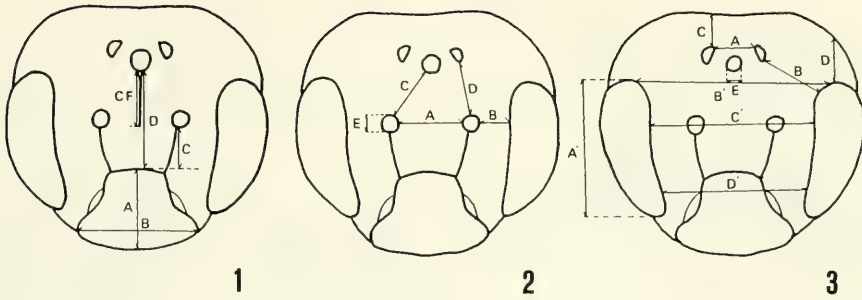


Fig 1-3. Têtes schématisées, vues de face, avec les mesures pour caractériser les espèces. – 1, Clypeus: longueur (A) et largeur (B); distances séparant la base du clypeus de l'insertion antennaire (C) et de l'ocelle médiane (D). Carène frontale: longueur (CF); 2, Antennes: distances séparant les insertions des antennes (A); l'insertion antennaire du bord de l'œil (B), de l'ocelle médiane (C) et de l'ocelle latérale la plus proche (D); diamètre de l'insertion antennaire (E). Espace malaire: longueur (A) et largeur (B) (non représentées); 3, Ocelles: distances séparant les ocelles latérales (A); une ocelle latérale du bord de l'œil le plus proche (B) et du bord postérieur de la tête (C); l'apex de l'œil du bord postérieur de la tête (D); diamètre de l'ocelle médiane (E). Yeux: longueur de l'œil (A'); distances interoculaires au niveau du sommet de yeux (B'), des insertions antennaires (C') et de la base des yeux (D').

Agronomie de Montpellier (ENSAM, Prof. F. Leclant), Faculté des Sciences Agronomique de Gembloux (ESAGX, Prof. C. Gaspar), Instituut voor Taxonomische Zoölogie Amsterdam (ZMA, M. W. Hogenes), Museum für Naturkunde der Humboldt-Universität Berlin (MNHUB, Dr F. Koch), Muséum National d'Histoire Naturelle de Paris (MNHN, Dr J. Weulersse), Muséum d'Histoire Naturelle de Strasbourg (MHNS, Dr J. Matter), Natural History Museum London (BMNH, M. T. Huddleston), Università di Catania (U.C., Dr V. Nobile), Université de Mons-Hainaut (UMH, Prof. P. Rasmont), coll. Prof. J. Lelercq (Gembloux), coll. Prof. L. Plateau (Vandoeuvre-les-Nancy), coll. Dr M. Comba (Cecchina di Albano Laziale), coll. Dr G. Delvare (Montpellier), coll. Dr J. Hamon (Gaillard), coll. Ir. R. Fonfria (Eygalières), coll. Ing. G. van der Zanden (Eindhoven) (maintenant dans le RMNH), coll. Pater A. W. Ebmer

(Puchenau, Autriche), coll. A. Foucart (Montpellier), coll. J.-M. Maldès (Montpellier), coll. A. Pauly (Gembloux), coll. M. Schwarz (Ausfelden, Autriche), coll. R. Wahis (Gembloux). La somme du matériel revu par les auteurs s'élève à 1486 spécimens.

Ces données ainsi que les données bibliographiques de Balles (1925, 1927, 1933), Daly (1983), Pagliano (1994) et Westrich (1990) ont été gérées à l'aide du logiciel Microbanque Faune-Flore (Rasmont et al. 1993). Le montant total des spécimens s'élève ainsi à 1935 spécimens. Les cartes ont été établies à l'aide du logiciel Carto Fauna-Flora 1.2 (Barbier & Rasmont 1995, 1996). La carte orographique de la Turquie a été saisie au départ de cartes au 1/2.000.000 à l'aide même logiciel.

La nomenclature des types de distribution est inspirée de de Lattin (1967).

Tableau 2. *Ceratina* spp. Biométrie des mâles. Pour l'explication des mesures A-E, voir fig. 1-3, (unité 0.01 mm).

	<i>C. callosa</i>	<i>C. chalybea</i>	<i>C. acuta</i>	<i>C. zwakhalsi</i>
Longueur de l'aile	600	700	460	490
Nombre de hamuli	7	7	6 - 7	6
Yeux: A, B, C, D	132, 158, 134, 119	139, 173, 140, 131	128, 143, 120, 95	120, 140, 113, 97
Clypeus: A * B, C, D	64 * 98, 42, 100	77 * 99, 45, 102	55 * 85, 31, 83	61 * 78, 35, 85
Antennes: A, B, C, D, E	42, 29, 45, 56, 16	46, 30, 47, 54, 18	39, 27, 42, 50, 15	32, 24, 39, 49, 15
Carène frontale	69	64	43	56
Ocelles: A, B, C, D, E	32, 51, 19, 55, 16	34, 54, 19, 55, 18	35, 40, 16, 45, 15	29, 43, 14, 41, 15
Espace malaire: A*B	4 * 45	6 * 58	1 * 48	4 * 35
Nombre d'articles au palpe maxillaire	6	6	6	6

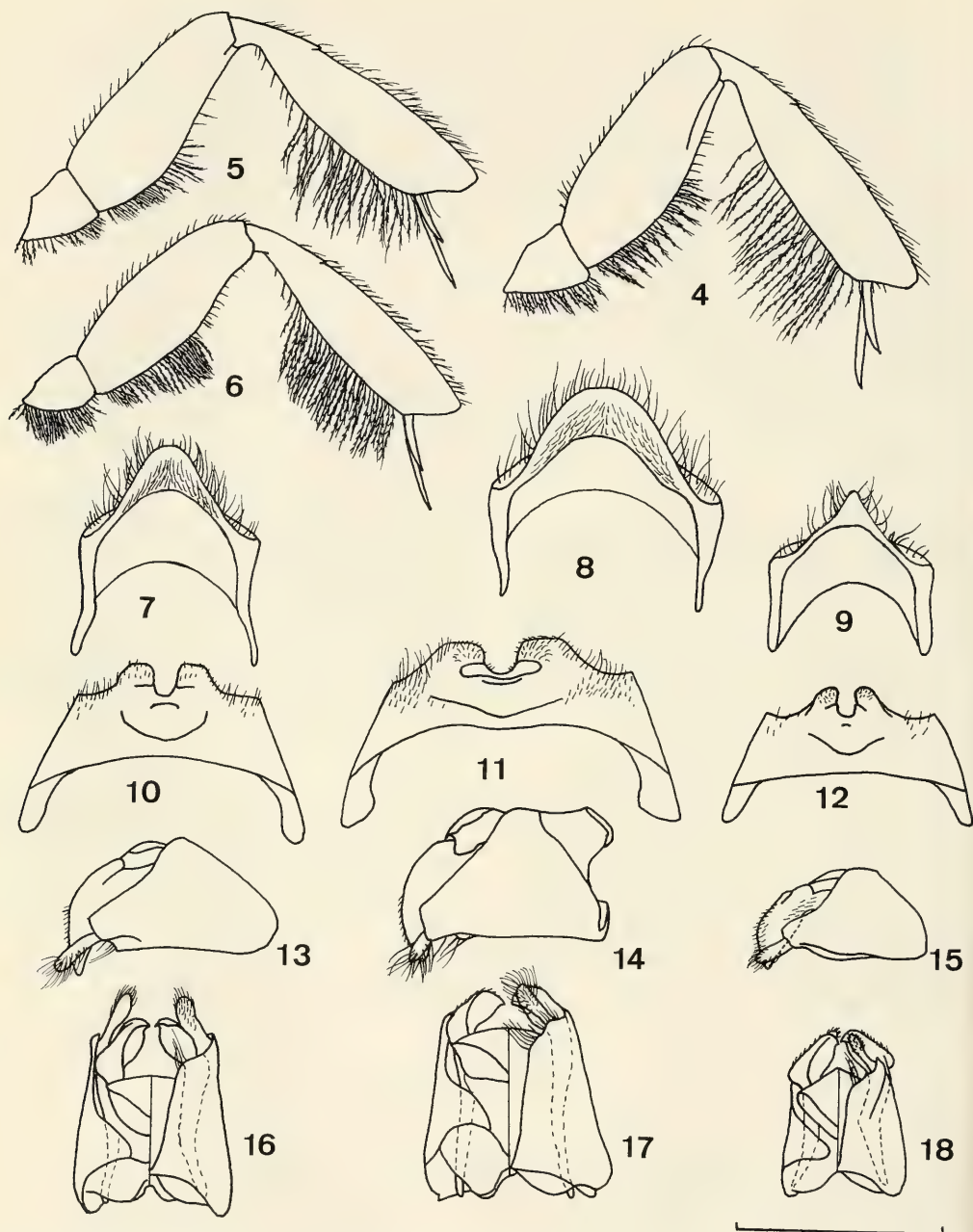


Fig. 4-18. *Ceratina* spp., détails du mâle. — 4, 7, 10, 13, 16, *C. callosa* ♂; 5, 8, 11, 14, 17, *C. chalybea* ♂; 6, 9, 12, 15, 18: *C. zwakhalsi* ♂; 4-6, patte postérieure; 7-9, tergite 7 en vue ventrale; 10-12, sternite 6; 13-15, profil droit du genitalia; 16-18, genitalia en vue dorsale (moitié gauche) et en vue ventrale (moitié droite). Echelle: 1 mm.

Tableau 3. *Ceratina* spp. Biométrie des femelles. Pour l'explication des mesures A-E, voir fig. 1-3, (unité 0.01 mm).

	<i>C. callosa</i>	<i>C. chalybea</i>	<i>C. acuta</i>	<i>C. zwakhalsi</i>
Longueur de l'aile	600	600	450	440
Nombre de hamuli	7	7	6	6
Yeux: A, B, C, D	156, 182, 157, 139	150, 178, 154, 147	131, 152, 133, 112	121, 138, 116, 100
Clypeus: A * B, C, D	73 * 112, 40, 107	77 * 115, 44, 108	63 * 89, 33, 91	56 * 84, 32, 88
Antennes: A, B, C, D, E	50, 36, 55, 62, 17	49, 36, 54, 61, 17	42, 31, 46, 53, 15	35, 27, 47, 53, 14
Carène frontale	69	71	65	61
Ocelles: A, B, C, D, E	37, 54, 24, 62, 17	35, 57, 27, 66, 18	31, 48, 20, 51, 15	29, 44, 15, 49, 13
Espace malaire: A*B	4 * 59	6 * 63	3 * 49	4 * 43
Nombre d'articles au palpe maxillaire	6	6	6	6

***Ceratina (Euceratina) zwakhalsi* sp. n.**

Locus typicus. – Turquie, Hakkâri, Suvarihalil Geçidi (37°30'N 43°23'E), 2.500 m.

Étiquettes de l'holotype. – 'Turkey Hakkâri Suvari Halil Pass 27-VI 1985 2500 m C. J. Zwakhals' [imprimée]; 'Museum Leiden *Ceratina mandibularis* Friese ♂ det. G. v. d. Zanden 1986' [en partie imprimée et manuscrite]; 'Terzo M. det. 1995 *Ceratina zwakhalsi* HOLOTYPE' [mécanographiée sur papier rouge]. Collection RMNH.

Paratypes (4 ♀, 31 ♂) – Prov. Agri: Agri (39°55'N 43°03'E), 1 ♂ 28.v.1980 leg. M. Schwarz (coll. Schwarz). Prov. Bitlis: Nemrut Dagı (38°40'N 42°12'E), 1 ♂ 16.viii.1991 leg. K. Warncke (ooll); Tatvan (38°30'N 42°16'E), 1 ♂ 16.viii.1991 leg. K. Warncke (ooll). Prov. Elazığ: Elazığ (38°41'N 39°14'E), 1 ♂ 7.vi.1980 leg. M. Schwarz, (coll. Schwarz). Prov. Erzincan: Refahiye (39°54'N 38°46'E), 1 ♂ 23.viii.1991 leg. K. Warncke (ooll). Prov. Hakkâri: Hakkâri, Suvarihalil Geçidi (37°30'N 43°23'E), 2 ♂ 2.vi.1980 leg. K. Warncke (ooll); İkizdağ (37°20'N 44°15'E), 2 ♀ 9 ♂ 10.vi.1981 leg. K. Warncke (ooll); Tanin Dağları (37°29'N 43°00'E) 1 ♀, 2 ♂ 2.vi.1980 leg. K. Warncke (ooll), 3 ♂ 25.vi.1985 leg. M. Schwarz (coll. Schwarz); Varagoz (37°15'N 44°08'E), 1 ♂ 15.vi.1984, 1 ♀ 17.vi.1984 leg. K. Warncke (ooll); Yuksekova (37°35'N 44°17'E), 1 ♂ 28.vi.1985 leg. M. Schwarz (coll. Schwarz). Prov. Icel: Sertavul (?), 2 ♂ 9.vi.1978 leg. M. Schwarz (coll. Schwarz). Prov. Kahraman Maras: Goksun (38°03'N 36°30'E), 1 ♂ 10.vii.1990 leg. P. A. Ebmer (coll. Ebmer). Prov. Kars: Karakurt (40°09'N 42°25'E), 1 ♂ 1.vi.1988, 1 ♂ 2.vi.1988 leg. K. Warncke (ooll); Karakurt (40°10'N 42°36'E), 1 ♂ 23.v.1975 leg. K. Warncke (ooll); Karakurt (40°10'N 42°29'E), 1 ♂ 23.v.1975 leg. K. Warncke (ooll); Karakurt (40°08'N 41°39'E), 1 ♂ 27.v.1980 leg. M. Schwarz, (coll. Schwarz). Prov. Sivas: Gurun (38°44'N 37°15'E), 1 ♂ 7.vii.1984 leg. P. A. Ebmer (coll. Ebmer); Gurun (38°44'N 37°15'E), 1 ♂ 3.vi.1978 leg. M. Schwarz (coll. Schwarz). Prov. Van: Baskale (38°03'N 44°01'E), 1 ♂ 9.vii.1984, 1 ♂ 12.vii.1984 leg. P. A. Ebmer (coll. Ebmer); Baskale (38°26'N 44°26'E), 1 ♂ 30.v.1980 leg. M. Schwarz (coll. Schwarz); Ercis (39°01'N 43°13'E), 1 ♂ 3.viii.1983 leg. K. Warncke (ooll).

**Description (Holotype ♂)**

Voir tableaux 1 à 3; pattes postérieures comme à la figure 6; tergite 7 comme à la figure 9; sternite 6 comme à la figure 12; genitalia comme aux figures 15 et 18. Le sternite 6, le tergite 7 et le genitalia ont été disséqués par les auteurs et collés sur une étiquette de plastique transparent.

**Espèces voisines et diagnose différentielle**

Les trois espèces dont les mâles peuvent être confondus avec *C. zwakhalsi* sont *C. callosa* (Fabricius, 1794), *C. chalybea* Chevrier, 1872 et *C. acuta* Friese, 1896.

Ces mâles sont facilement reconnaissables par la pilosité des pattes postérieures et la forme du dernier segment abdominal. Seul le mâle de *C. acuta* possède une pilosité ventrale de la moitié basale du fémur qui soit uniformément longue (fig. 19). Dans le cas de *C. callosa*, cette pilosité est uniformément courte (fig. 4). *C. chalybea* diffère de *C. callosa* par la présence de quelques soies longues à l'apex de cette pilosité fémorale (fig. 5). *C. zwakhalsi* possède lui une pilosité fémorale courte à la base mais qui s'allonge progressivement vers l'apex (fig. 6). La forme du dernier tergite permet également de reconnaître facilement ces quatre espèces. L'apex de ce tergite est en effet largement arrondi chez *C. chalybea* (fig. 8), moins arrondi et aux marges latérales concaves chez *C. callosa* (fig. 7), pointu, formant un angle presque droit avec des côtés droits chez *C. acuta* (fig. 20) et très pointu avec des marges latérales concaves chez *C. zwakhalsi* (fig. 9).

On sépare assez aisément les femelles de *C. callosa* et *C. chalybea* des femelles de *C. acuta* et *C. zwakhalsi* par la forme arrondie de la carène hypostomienne chez les deux premières espèces et droite chez les deux dernières. *C. chalybea* se distingue alors de *C. callosa* par la présence d'un élargissement de la partie postérieure de la carène hypostomienne. Ces caractères sont également valables pour les mâles (fig. 44 à 46).



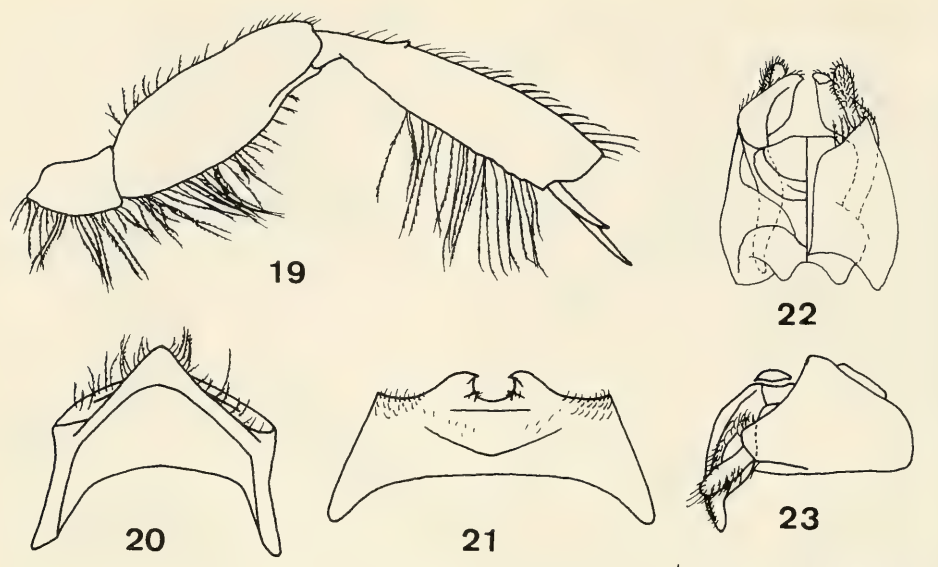


Fig. 19-23. *Ceratina acuta* ♂. – 19, patte postérieure; 20, tergite 7 en vue ventrale; 21, sternites 6; 22, genitalia en vue dorsale (moitié gauche) et en vue ventrale (moitié droite); 23: profil droit du genitalia. Echelle: 1 mm.

On distingue beaucoup plus difficilement la femelle de *C. acuta* de celle de *C. zwakhalsi*. Ces deux espèces possèdent une tache clypeale réduite ou absente. Il semble toutefois que cette tache soit plus souvent présente chez *C. zwakhalsi* que chez *C. acuta*. On peut cependant les distinguer par la ponctuation de la face et du thorax. Dans le cas de *C. acuta*, ces ponctuations sont plus petites et plus nombreuses. On peut compter ainsi au moins 6 ponctuations de front sur l'aire supraclypeale, le long de la suture supraclypeale (fig. 25). On en compte rarement plus de cinq chez *C. zwakhalsi* (fig. 24). On peut également compter de 8 à 10 ponctuations sur une droite fictive reliant la base des notauli du mesoscutum de *C. acuta* (fig. 27). On en compte rarement plus de 6 à 8 chez *C. zwakhalsi* (fig. 26). Elles sont en outre, chez cette dernière, plus larges et plus distantes les unes des autres, laissant souvent apparaître de larges zones impunctuées.

## Clé

Les seules clés des cératines incluant la région méditerranéenne sont celles de Friese (1896, 1901). Dans le cas des femelles, selon que l'on soit en présence d'un spécimen présentant ou pas une marque blanche sur le clypeus, la clé de Friese nous conduit respectivement à *C. callosa* ou à *C. acuta*. Ce problème ne se pose pas dans le cas des mâles où l'on aboutit uniquement à *C. acuta*. La clé de Friese devrait donc être modifiée comme suit:

## Femelles

11. Grande taille, 12 à 14 mm de long ... *C. chalcites* Latreille
  - Petite taille, 6 à 9 mm de long.....11a
  - 11a. Carène hypostomienne courbe.....11b
  - Carène hypostomienne droite *C. zwakhalsi* sp. n.
  - 11b. Carène hypostomienne étroite sur toute sa longueur..... *C. callosa* Fabricius
    - Carène hypostomienne étroite à la base et élargie postérieurement..... *C. chalybea* Germar
20. Lobes pronotaux noirs, 6 à 7 mm de long.....21
  - Lobes pronotaux blancs, 6 à 8 mm de long ..20a
  - 20a. 8 à 10 ponctuations entre les bases des notauli du mesoscutun; au moins 6 ponctuations de front derrière la suture clypeale postérieure ..... *C. acuta* Friese
    - 6 à 8 ponctuations entre les bases des notauli du mesoscutun; rarement plus de 5 ponctuations de front derrière la suture clypeale postérieure ..... *C. zwakhalsi* sp. n.

## Mâles

9. Clypeus, labre et mandibules entièrement blancs, corps plus verdâtre ..... *C. mandibularis* Friese
  - Mandibules entièrement noires, corps bleu ....9a
  - 9a. Fémur postérieur doté d'une pilosité ventrale uniformément longue; terite 7 triangulaire à l'apex, au sommet émoussé et aux marges droites ou légèrement concaves; labre noir ou doté

d'une petite marque blanche centrale.....

..... *C. acuta* Friese

— Fémur postérieur doté d'une pilosité ventrale courte à la base et s'allongeant vers l'apex; tergite 7 fortement pointu à l'apex, aux marges latérales concaves; labre presque entièrement blanc.....

..... *C. zwakhalsi* sp. n.

### Aires de distribution

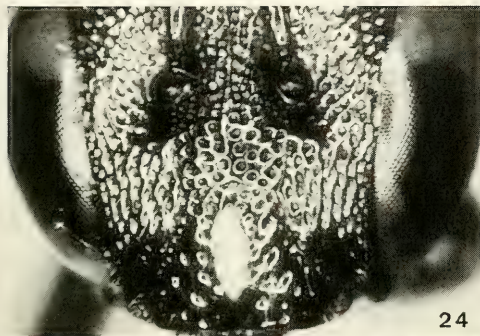
L'aire de distribution de *C. callosa* apparaît clairement comme de type atlanto-méditerranéenne (fig. 53). Elle couvre en effet tout le maghreb et s'étend vers le nord jusqu'à la péninsule ibérique, le sud de la France, la péninsule italique, la Corse, la Sardaigne et la Sicile.

L'aire de distribution de *C. chalybea* est de type euro-méditerranéenne (fig. 54). On trouve cette espèce depuis le Maghreb jusqu'en Allemagne et en Autriche vers le nord et jusque dans la province de Van en Turquie vers l'est.

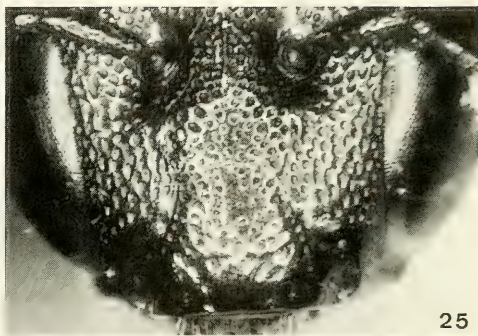
L'aire de distribution de *C. acuta* (fig. 53) est de type est-méditerranéenne étendue vers le nord et vers l'ouest. On la trouve ainsi principalement en Turquie et en Grèce. Elle est également présente dans les pays de l'est comme la Bulgarie, la Roumanie, l'ex-

Yugoslavie et la Tchéquie. Un spécimen a également été capturé dans le sud-est de l'Allemagne. Il apparaît ici évident que la limite nord-ouest de distribution de cette espèce n'atteint pas les frontières italienne, protégée par les Alpes, et suisse, trop à l'ouest. Plus au sud, elle n'a apparemment pas franchi la Mer Adriatique vers l'Italie, ni atteint la Sicile. Il est donc plus qu'improbable que *C. acuta* puisse être présente en Espagne comme Dusmet (1923), et plus récemment Pérez-Inigo Mora & Gayubo (1989) entre autres, le signalent. Il se pourrait que ces auteurs aient confondu *C. acuta* avec *C. cyanea* (Kirby) dont certains spécimens ont les lobes pronotaux blancs en péninsule ibérique. Vers l'est, on trouve *C. acuta* jusqu'à la frontière iranienne. Un spécimen a été trouvé en Israël et un autre dans les montagnes du Bolshoy.

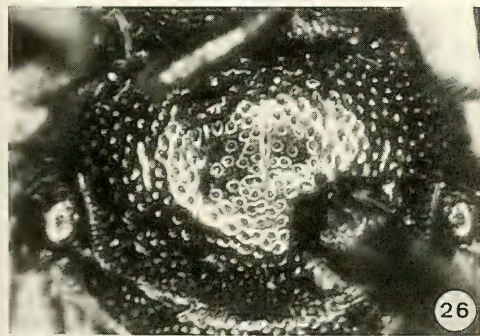
L'aire de distribution de *C. zwakhalsi* (fig. 55) semble se restreindre à l'est de la Turquie et serait de type syrienne. Il est cependant possible que cette espèce soit présente ou même originaire d'Iran ou d'Asie centrale. Tous les individus de cette espèce, à l'exception d'un seul, ont été trouvés à une altitude supérieure à 2000 mètres. Il s'agirait là de la seule espèce de cératine ouest-paléarctique décrite dont la distribution soit exclusivement montagnarde.



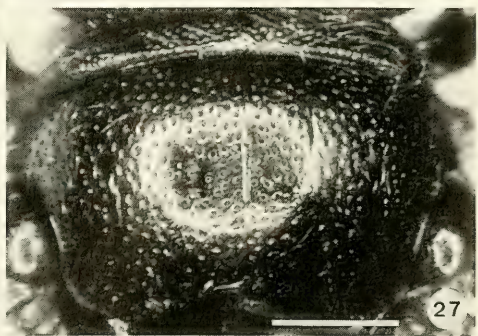
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25



26



27

Fig. 24-27, *Ceratina* spp. — 24, 26, *C. zwakhalsi* ♀; 25, 27, *C. acuta* ♀. 24, 25, tête vue de face; 26, 27, mesoscutum en vue dorsale, partie antérieure orientée vers le haut. Echelle: 0,5 mm.

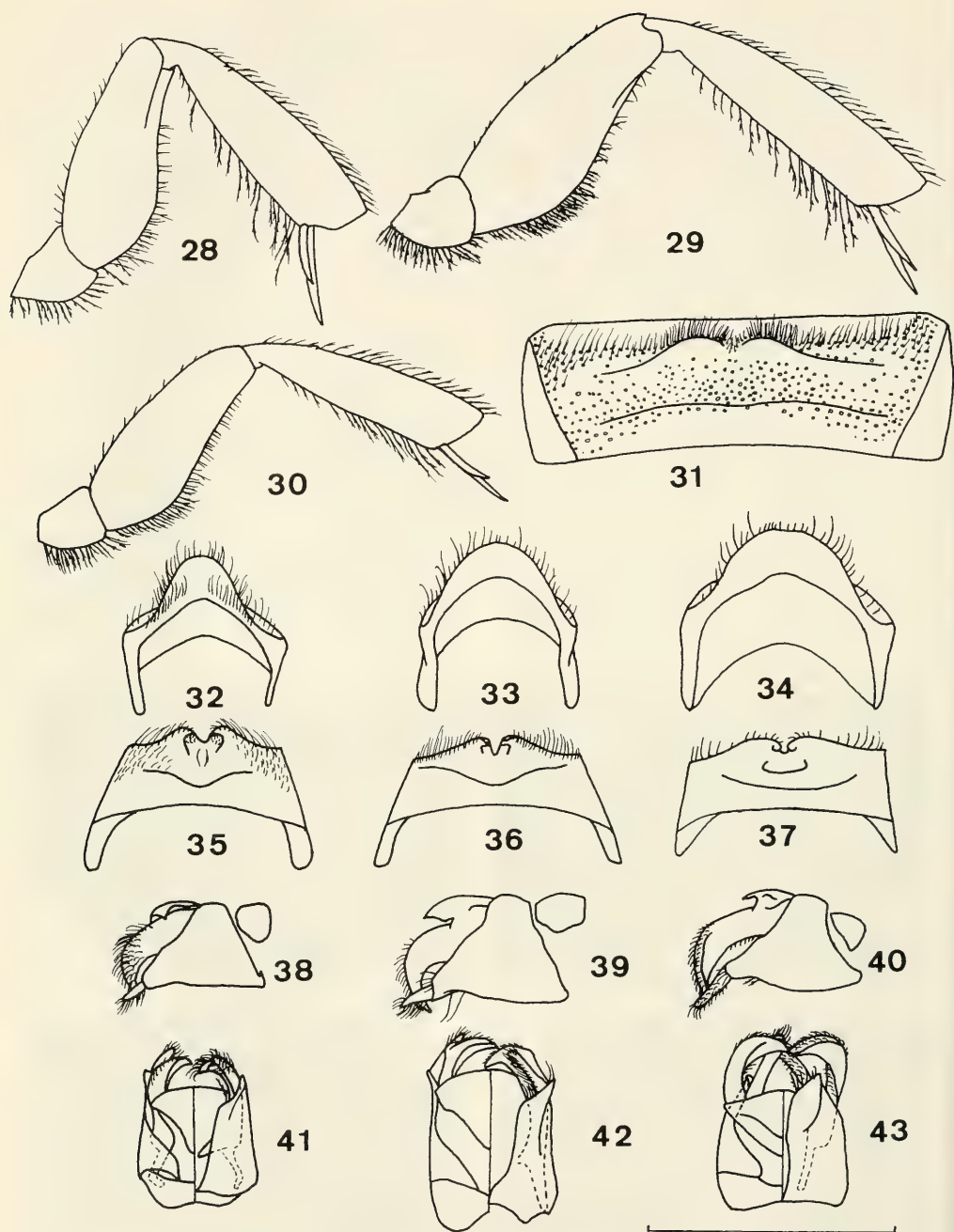


Fig. 28-43. *Ceratina* spp., détails du mâle. — 28, 31, 32, 35, 38, 41, *C. maghrebensis* ♂; 29, 33, 36, 39, 42, *C. saundersi* ♂; 30, 34, 37, 40, 43, *C. verhoeffi* ♂. 28-30, patte postérieure; 31, sternite 4; 32-34, tergite 7 en vue ventrale; 35-37, sternite 6; 38-40, profil droit du genitalia; 41-43, genitalia en vue dorsale (moitié gauche) et en vue ventrale (moitié droite). Echelle: 1 mm.



Tableau 4. *Ceratina* spp. Caractères cuticulaires et pelage.

	<i>C. maghrebensis</i>	<i>C. saundersi</i>	<i>C. verhoeffi</i>
<b>Coloration générale</b>	♂ - ♀ : métallique à reflets verdâtres, sternites noirâtres	♂ - ♀ : bleu métallique, sternites noirâtres	♂ - ♀ : vert métallique à reflets dorés, sternites noirâtres
<b>Labre</b>	♂ - ♀ : noir	♂ - ♀ : noir	♂ : noir, avec une petite marque ivoire centrale ♀ : noir
<b>Clypeus</b>	♂ : ivoire, étroitement bordé de noir; ponctuation moins abondante que <i>verhoeffi</i> sur tout le clypeus ♀ : avec une tache centrale oblongue allant du sommet du clypeus jusqu'au premier quart de la longueur du clypeus	♂ : ivoire, très largement bordé de noir; ponctuation éparse sur tout le clypeus ♀ : avec une tache centrale oblongue allant du sommet du clypeus jusqu'au premier tiers de la longueur du clypeus	♂ : ivoire, étroitement bordé de noir; ponctuation éparse mais un peu regroupée sur la bande centrale ♀ : avec une grande tache centrale trapézoïdale allant du sommet du clypeus jusqu'au premier quart de la longueur du clypeus et deux fois plus large à la base qu'à l'apex
<b>Carène hypostomienne</b>	♂ - ♀ : étroite et légèrement convexe sur toute sa longueur (fig. 47)	♂ - ♀ : comme <i>maghrebensis</i> (fig. 48)	♂ - ♀ : étroite et moins convexe que <i>maghrebensis</i> (fig. 49)
<b>Lobes pronotaux</b>	♂ - ♀ : entièrement ivoire	♂ - ♀ : idem	♂ - ♀ : idem
<b>Mesonotum</b>	♂ - ♀ : partie dorsale très densément et irrégulièrement ponctuée; 5 à 6 ponctuations entre les notauli et la ligne médiane, espacées par une distance égale ou plus petite que le diamètre d'une ponctuation; ponctuations contigües au centre du mesonotum, directement en arrière de la ligne médiane	♂ - ♀ : partie dorsale densément et régulièrement ponctuée; 4 à 5 ponctuations entre les notauli et la ligne médiane, espacées par une distance plus grande que le diamètre d'une ponctuation	♂ - ♀ : partie dorsale densément et irrégulièrement ponctuée; 4 à 5 ponctuations entre les notauli et la ligne médiane, souvent espacées par une distance plus grande que le diamètre d'une ponctuation; ponctuations contigües sur les deux tiers postérieurs du mesonotum, bien en arrière de la ligne médiane
<b>Patte antérieure</b>	♂ - ♀ : avec une petite marque basitibiale ivoire	♂ - ♀ : comme <i>maghrebensis</i>	♂ - ♀ : avec une marque basitibiale ivoire étendue sur plus des deux tiers de la longueur du tibia
<b>Patte médiane</b>	♂ - ♀ : avec une petite marque basitibiale ivoire	♂ - ♀ : comme <i>maghrebensis</i>	♂ - ♀ : avec une petite marque ivoire basitibiale étendue sur près du quart basal du tibia
<b>Fémur postérieur</b>	♂ : pilosité de la moitié basale courte et éparse (fig. 28)	♂ : pilosité de la moitié basale en forme de brosse très courte, de longueur constante mais plus dense que chez <i>verhoeffi</i> (fig. 29)	♂ : pilosité de la moitié basale en forme de brosse très courte et de longueur constante (fig. 30)
<b>Tibia postérieur</b>	♂ - ♀ : avec une marque basitibiale ivoire n'atteignant pas le quart de la longueur du tibia ♂ : pilosité ventrale plus courte que la plus grande largeur du tibia (fig. 28)	♂ - ♀ : marque basitibiale comme <i>maghrebensis</i> ♂ : pilosité ventrale comme <i>maghrebensis</i> (fig. 29)	♂ - ♀ : avec une marque basitibiale ivoire étendue sur près des deux tiers de la longueur du tibia ♂ : pilosité ventrale comme <i>maghrebensis</i> (fig. 30)
<b>Sternites 2 à 5</b>	♂ : avec deux larges lobes submédians imponctués sur la marge postérieure des sternites; marge postérieure du sternite 5 échancrée (fig. 31)	♂ : sans lobes submédians imponctués; marge postérieure du sternite 5 plus échancrée que chez <i>maghrebensis</i>	♂ : sans lobes submédians imponctués; marge postérieure du sternite 5 non échancrée
<b>Sternite 6</b>	♂ : marge postérieure avec deux larges lobes submédians peu élevés et légèrement recouverts à leur base interne par un lobe médian large et tronqué à l'apex (fig. 35)	♂ : marge postérieure avec deux larges lobes submédians peu élevés et dont les marges internes sont ramenées ventralement vers l'extérieur (fig. 36)	♂ : fort semblable à <i>saundersi</i> (fig. 37)
<b>Carène du tergite 6</b>	♀ : présente uniquement à l'apex du tergite où elle développe une petite convexité qui disparaît juste avant l'apex acuminé du tergite (fig. 51)	♀ : longue et droite sur toute sa longueur (fig. 52)	♀ : comme <i>saundersi</i>
<b>Tergite 7</b>	♂ : apex arrondi et très proéminent (fig. 32)	♂ : apex largement arrondi et peu proéminent (fig. 33)	♂ : apex très largement arrondi et peu proéminent (fig. 34)
<b>Genitalia</b>	♂ : voir figures 38 et 41	♂ : voir figures 39 et 42	♂ : voir figures 40 et 43

Fig. 44-49.

*Ceratina* spp., profil gauche de la tête. La carène hypostomienne est indiquée par une flèche. — 44, *C. callosa* ♂; 45, *C. chalybea* ♂; 46, *C. zwakhalsi* ♂; 47, *C. maghrebenensis* ♂; 48, *C. saundersi* ♂; 49, *C. verhoeffi* ♂.

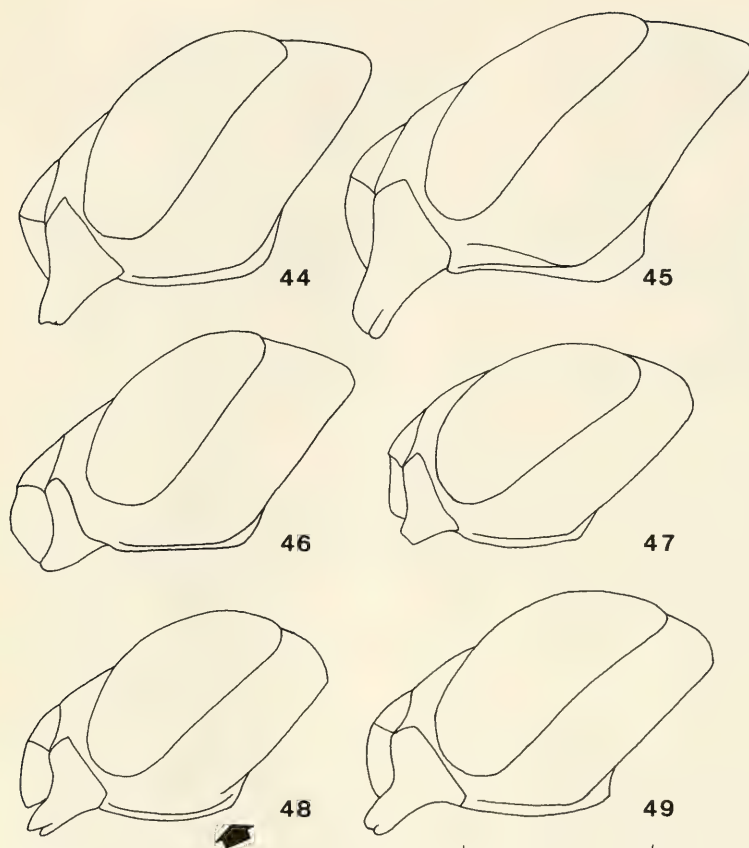


Tableau 5. *Ceratina* spp. Mesures et ratio des mâles. Pour l'explication des mesures A-E, voir fig. 1-3, (unité 0.01 mm).

	<i>C. maghrebenensis</i>	<i>C. saundersi</i>	<i>C. verhoeffi</i>
Longueur de l'aile	420	400	460
Nombre de hamuli	5	5	5
Yeux: A, B, C, D	109, 125, 104, 89	111, 114, 97, 83	129, 125, 107, 94
Clypeus: A * B, C, D	57 * 75, 31, 74	52 * 64, 32, 80	61 * 78, 32, 82
Antennes: A, B, C, D, E	33, 22, 40, 47, 14	32, 22, 41, 50, 13	34, 22, 40, 50, 15
Carène frontale	56	52	56
Ocelles: A, B, C, D, E	24, 33, 9, 36, 16	25, 33, 8, 33, 15	27, 29, 15, 31, 16
Espace malaire: A*B	3 * 39	2 * 39	2 * 42
Nombre d'articles au palpe maxillaire	5	5	5

Tableau 6. *Ceratina* spp. Mesures et ratio des femelles. Pour l'explication des mesures A-E, voir fig. 1-3, (unité 0.01 mm).

	<i>C. maghrebensis</i>	<i>C. saundersi</i>	<i>C. verhoeffi</i>
Longueur de l'aile	390	430	440
Nombre de hamuli	6	5	5
Yeux: A, B, C, D	111, 126, 110, 94	127, 128, 116, 101	130, 130, 115, 101
Clypeus: A * B, C, D	52 * 79, 25, 77	57 * 84, 31, 86	62 * 82, 28, 85
Antennes: A, B, C, D, E	33, 25, 42, 49, 14	38, 25, 45, 54, 14	39, 23, 46, 55, 15
Carène frontale	56	57	62
Ocelles: A, B, C, D, E	27, 34, 15, 38, 15	27, 35, 18, 41, 16	29, 31, 15, 37, 16
Espace malaire: A*B	2 * 41	2 * 45	3 * 43
Nombre d'articles au palpe maxillaire	5	5	5

### Derivatio nominis

Cette espèce est dédiée au Dr C. J. Zwakhals (Arkel, Pays-Bas) qui a collecté l'holotype.

### *Ceratina (Euceratina) verhoeffi* sp. n.

Locus typicus. – Maroc, Marrakech (31°49'N 8°00'W).

Étiquettes de l'holotype. – 'Maroc Marrakech 18-20-V-1950 P M F Verhoeff [imprimée]; 'Museum Leiden *Ceratina saundersi* Daly ♂ det. G. v. d. Zanden 1988' [en partie manuscrite et imprimée]; 'Terzo M. det. 1994 *Ceratina verhoeffi* HOLOTYPE' [mécanographiée]. Collection RMNH.

Paratypes. – Prov. Agadir: Taroudant (30°29'N 8°52'W), 1 ♀ 4♂ 24.vi.1974 leg. K. Guichard & G. Else (BMNH); Prov. Marrakech: Imouzzar (31°19'N 7°23'W), 2♂ 21.vi.1974 leg. K. Guichard & G. Else (BMNH); Ouirgane (31°11'N 8°05'W), 3 ♀ 8♂ 2.vii.1974 leg. K. Guichard & G. Else (BMNH). Prov. Ouarzazate: Ait Saoun (30°45'N 6°38'W), 1♂ 14.vii.1975 leg. J. Gusenleitner (BMNH); Tizi n'Bachkoum (30°39'N 7°17'W), 7♂ 1.vii.1987 leg. M. Schwarz (OOLL).

### Description (Holotype ♂)

Voir tableaux 4 à 6; pilosité des pattes postérieures comme à la figure 30; tergite 7 comme à la figure 34; sternite 6 comme à la figure 37; genitalia comme aux figures 40 et 43. Le tergite 7 et le genitalia ont été disséqués par les auteurs et collés sur une étiquette de plastique transparent.

### Espèces voisines et diagnose différentielle

Les deux espèces sympatriques qui peuvent être confondues avec *C. verhoeffi* sont *C. saundersi* Daly, 1983 et *C. maghrebensis* Daly, 1983. Ces espèces sont comparées à *C. verhoeffi* dans les tableaux 4 à 6.

Ces trois espèces forment un groupe d'espèces ho-

mogène caractérisé notamment par des palpes maxillaires à 5 articles au lieu de six (caractère également présent chez *C. albosticta* Cockerell, 1931), une hanche doté d'une large dent sur la marge ventrale, donnant à l'apex de la hanche un aspect tronqué bien différent de la forme conique habituelle (fig. 50) et par une taille plus petite que celle des autres espèces du même sous-genre à l'exception de *C. dentiventris* Gerstaecker, 1869 et de *C. dallatorreana* Friese, 1896. Les auteurs proposent de nommer "groupe de *C. maghrebensis*" l'ensemble de ces trois espèces.

On distingue *C. verhoeffi*, mâle et femelle, facilement grâce aux taches basitibiales ivoires des pattes antérieures et postérieures qui s'étendent au delà de la moitié de la longueur des tibias, ce qui n'est jamais le cas chez les deux autres espèces. *C. verhoeffi* arbore également une coloration vert métallique bien prononcée contrairement à la coloration bleu de *C. saundersi* et à la coloration légèrement verdâtre de *C. maghrebensis*. Le mâle de *C. maghrebensis* se distingue alors aisément de celui de *C. saundersi* par la présence sur les sternites deux à cinq de zones transversales im-ponctuées et élevées en formes de lamelles (fig. 31). Les femelles se distinguent par la forme de la carène du sixième tergite abdominal. Celle-ci est pratiquement droite chez *C. saundersi* (fig. 52), tout comme celle de *C. verhoeffi*, et courte avec une extrémité nettement convexe chez *C. maghrebensis* (fig. 51).

### Clé

On doit à Daly (1983) d'avoir publié la dernière clé en date pour les cératines du Maghreb. La découverte de *C. verhoeffi* dans la région de Marrakech modifie sa clé comme suit:



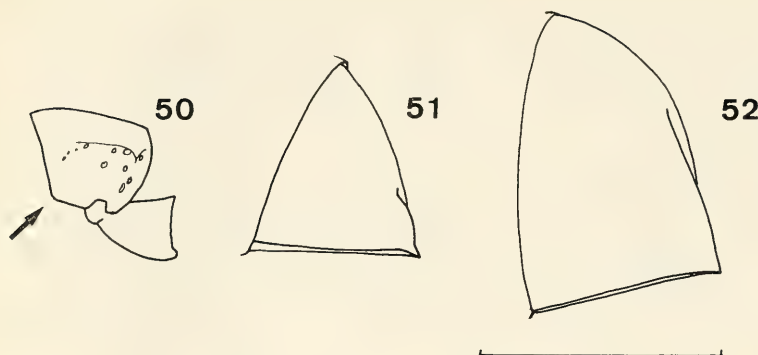


Fig. 50-52.

50, profil gauche de la hanche et du trochanter postérieurs gauches de *C. maghrebensis* ♂.

51-52, Profil gauche du tergite 6. -51, *C. maghrebensis* ♀; 52, *C. saundersi* ♀.

Echelle: 1 mm.

### Mâles

- 13 Sternites 2 à 5 non modifiés, entièrement ponctués .....13a
- Sternites 2 à 5 dotés chacun d'une zone bilatérale imponctuée, élevée, en forme de croissant et dont les marges apicales portent de longues soies .....*Ceratina maghrebensis*
- 13a Taches basitibiales blanches des pattes postérieures et antérieures étendues dorsalement sur plus des deux tiers de la longueur des tibias; clypeus entièrement blanc .....*Ceratina verhoeffi*
- Taches basitibiales blanches des pattes postérieures et antérieures n'atteignant pas le quart de la longueur des tibias; clypeus avec de larges marges latéro-basales noires .....*Ceratina saundersi*

### Femelles

- 22 Carène médiane du tergite 6, vue de profil, plus longue et étroite; tache clypeale distincte, large; corps aux reflets métalliques bleu-vert .....22a
- Carène du tergite 6 plus courte, la marge avec une convexité subapicale distincte; tache clypeale mal définie, petite ou absente; corps aux reflets métalliques plus verdâtres .....*Ceratina maghrebensis*
- 22a Taches basitibiales blanches des pattes postérieures et antérieures étendues dorsalement sur plus des deux tiers de la longueur des tibias.. .....*Ceratina verhoeffi*
- Taches basitibiales blanches des pattes postérieures et antérieures n'atteignant pas le quart de la longueur des tibias .....*Ceratina saundersi*

### Aires de distribution

La distribution de *C. maghrebensis* est de type mauritanienne (fig. 56). On trouve cette espèce dans le centre du Maroc, le nord de l'Algérie et le nord de la Tunisie. Elle semble ainsi se limiter aux montagnes de l'Atlas marocaines et algériennes et aux régions

côtières méditerranéennes algériennes et tunisiennes.

La distribution de *C. saundersi* est de type atlanto-méditerranéenne (fig. 57). La figure 57 confirme la présence de cette espèce en Espagne depuis Daly (1983) et révèle une distribution largement étendue vers le nord jusqu'alors insoupçonnée:

Prov. Alicante: Benidorm 38°33'N 0°08'W (coll. J. Leclercq); Llosa de Camacho 38°46'N 0°00'E, 1 ♂ 21.vii.1989, leg. J. Selfa (OOLL); Moraira 38°40'N 7°57'E, 2 ♂ 4-10.ix.1989, 1 ♂ 4-13.ix.1989, 1 ♂ 26-27.ix.1989, 1 ♀ 12-18.ix.1989, 1 ♂ 6-11.III.1990, leg. R. Wahis (FSAGX). - Prov. Almeria: Almeria 36°53'N 2°21'W, 1 ♂ 1.viii.1984, leg. R. Hensen (coll. G. van der Zanden). - Prov. Cadiz: 30Km S-Cadiz 36°13'N 6°16'W, 1 ♀ 14.viii.1992, leg. K. Warncke (OOLL). - Prov. Granada: Albulol 36°47'N 3°11'W, 1 ♂ 15.iv.1979, leg. W. Schacht (OOLL); Salobrena 36°46'N 3°35'W, 1 ♂ 8.v.1983, leg. W. Perraudin (OOLL). - Prov. Jaen: Las Correderas 38°22'N 3°30'W, 1 ♂ 13.vi.1961, 1 ♂ 14.vi.1961, leg. J. van der Vecht (RMNH). - Prov. Malaga: Malaga 36°46'N 4°26'W, 1 ♂ viii.1987 (FSAGX); Ronda 36°45'N 5°07'W, 1 ♀ 25.vi.1969, leg. P.M.F. Verhoeff (RMNH); idem, 1 ♀ 11.vi.1986, leg. W. Perraudin (OOLL). - Prov. Sevilla: Sevilla 37°23'N 5°57'W, 1 ♂, leg. J. Dusmet (MNHNP). - Prov. Toledo: Toledo 39°53'N 4°01'W, 1 ♂ 25-27.vii.1967, leg. P.M.F. Verhoeff (RMNH).

Un individu mâle capturé par Friese (MNHUB) et renseigné "Pyrenaën" montre que *C. saundersi* atteint le nord de sa distribution dans les Pyrénées. Déterminé par Friese comme étant un mâle de *Ceratina dalla-torreana* Friese, 1896, il est très probable qu'il s'agisse là du spécimen ayant servi à Friese pour décrire le mâle de cette espèce.

La carte de distribution de *C. saundersi* montre pour la première fois sa présence au Portugal: Prov. Algarve: Alcoutim 37°25'N 7°40'W, 2 ♂ 9.viii.1698, 1 ♂ 20.viii.1968, leg. K. Warncke (OOLL); Olhao

37°04'N 7°49'W, 1 ♀ 22.viii.1968, leg. K. Warncke (OOLL); Tavira 37°13'N 7°45'W, 1 ♂ 29-31.viii.1984, leg. P. van Ooijen (ZMA).

Sa présence en Sardaigne (Italie) est confirmée depuis Pagliano, 1994 par les récoltes suivantes: Cagliari 39°14'N 9°05'E, 1 ♂ 10.vii.1959, 1 ♂ 13.vii.1959, leg. H. Wolf (MHNS); idem, 2 ♀ 1 ♂ 15.vii.1959, 1 ♂ 20.vii.1959, leg. H. Wolf (OOLL); Porto Santoru 39°37'N 9°39'E, 1 ♂ 12.vi.1936, leg. H.G. Amsel (MNHUB); Pula 39°00'N 8°55'E, 1 ♂ 20.iv.1960, leg. E. Priesner (OOLL).

L'est de sa distribution atteint l'île de Lampedusa au sud de la Sicile: Lampedusa 35°31'N 12°37'E, 1 ♂ 18.v.1987, leg. Arnone (OOLL). Elle atteint également le centre de l'Italie: Prov. Lazio, Terracina 41°19'N 13°11'E, 1 ♀ ix.1974, leg. T. Osten (OOLL). L'île de Lampedusa et la péninsule italique sont ainsi citées pour la première fois dans la distribution de *C. saundersi*.

*C. verhoeffi* présente une distribution de type mauritanienne stricte (fig. 58). Cette espèce présente cependant une distribution restreinte, voire endémique, à la vaste plaine de la province de Marrakech, avec des excursions au sud jusqu'à Taroudant (prov. Agadir) et à l'est jusqu'à Ait Saoun (prov. Ouarzazate).

### Derivatio nominis

Cette espèce est dédiée au Dr P. M. F. Verhoeff (Pays-Bas) qui a collecté l'holotype.

### REMERCIEMENTS

Nous remercions tout particulièrement Monsieur Gijs van der Zanden pour sa collaboration et le prêt de matériel qu'il nous a accordé. Nous remercions également toutes les personnes qui ont prêté ou permis l'accès au matériel de cette étude et qui sont cités dans l'introduction. Que tous les récolteurs du matériel étudiés, cités ci-après, soient également remerciés:

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Nous remercions enfin Mr D. Flagothier pour avoir réalisé la carte orographique de la Turquie.

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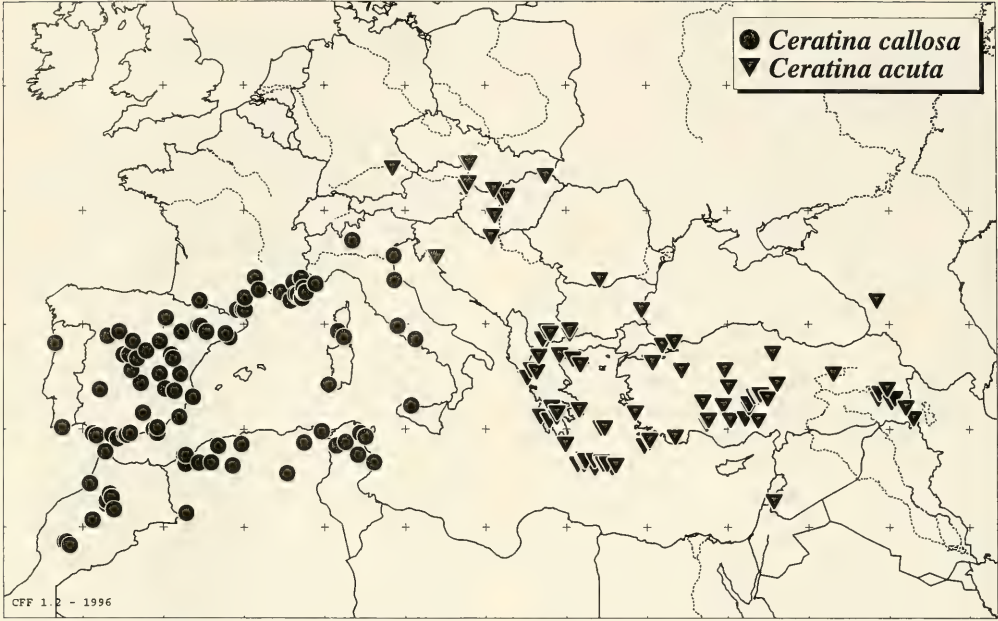


Fig. 53. Carte de distribution de *Ceratina callosa* et de *Ceratina acuta*.

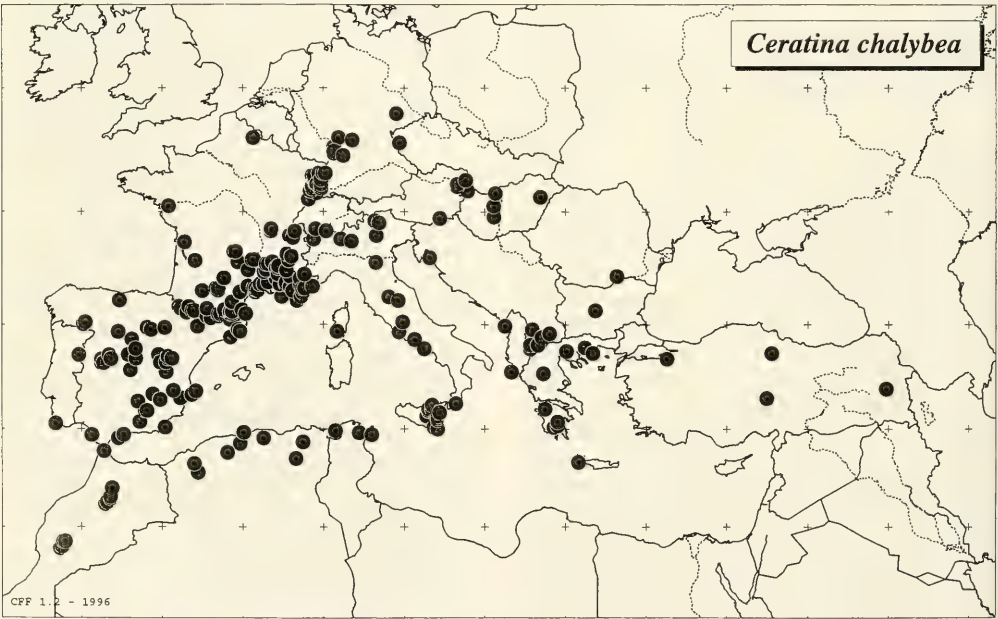


Fig. 54. Carte de distribution de *Ceratina chalybea*.





Fig. 55. Carte de distribution de *C. zwakhalsi*. En grisé: altitudes supérieures à 2000 m.



Fig. 56. Carte de distribution de *Ceratina maghrebensis*.



Fig. 57. Carte de distribution de *Ceratina saundersi*.

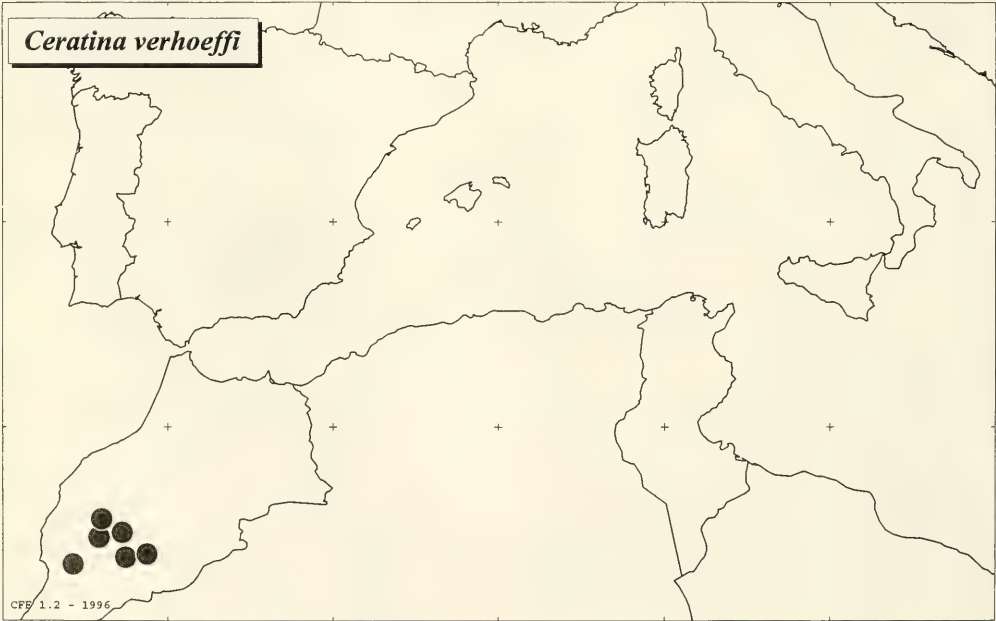


Fig. 58. Carte de distribution de *Ceratina verhoeffi*.

THE EASTERN PALEARCTIC RELATIVES OF  
EUROPEAN *DERAEOCORIS OLIVACEUS* (FABRICIUS)  
(HETEROPTERA: MIRIDAE)\*

Yasunaga, T. & Y. Nakatani, 1998. The eastern Palearctic relatives of European *Deraeocoris olivaceus* (Fabricius) (Heteroptera: Miridae). – Tijdschrift voor Entomologie 140 [1997]: 237–247, figs. 1–25. [ISSN 0040-7496]. Published 26 March 1998.

The eastern Palearctic deraeocorine plant bugs which have been incorrectly considered conspecific with the European *Deraeocoris olivaceus* (Fabricius) are revised. *Deraeocoris brachialis* Stål, which has been regarded as a synonym of *olivaceus*, is reinstated as valid, diagnosed and re-described. Two new species, *D. gibbantennatus* from the Primorskij Kraj, Russia and *D. erythromelas* from Shikoku and Kyushu, south-western Japan, are diagnosed and described. The European 'true' *D. olivaceus* is diagnosed, and a key to the species is provided. The zoogeography of the four allied species is discussed.

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Key words. – Heteroptera; Miridae; revision; *Deraeocoris olivaceus*; *D. brachialis*; new species; key; zoogeography.

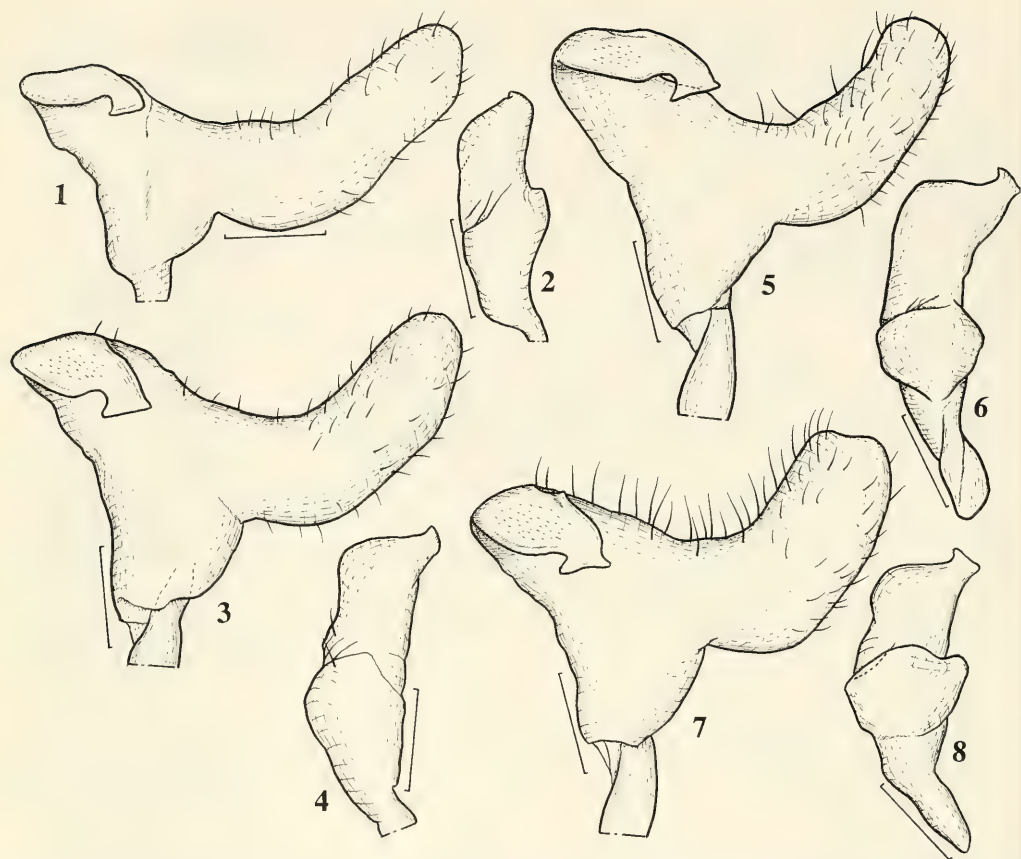
\*Contribution from the Russia/Japan Cooperative East-Asian Entomological Program, No. 49.

*Deraeocoris olivaceus* (Fabricius, 1777) is a conspicuous deraeocorine plant bug species, originally described from Germany, which is well known in Europe, because of its large size and predaceous habit. Stål (1858) described its relative, *D. brachialis*, from Irkutsk in southern Siberia, but this species was subsequently synonymised with *olivaceus* (Kerzhner 1988a). Although Kerzhner (1988b) referred to some different colour patterns in the specimens from the Russian Far East, he considered this as intraspecific variation. His treatment has been followed by subsequent authors (Miyamoto & Yasunaga 1989, Yasunaga 1990, Josifov 1992, Yasunaga & al. 1993, Lee & al. 1994, Vinokurov & Kanyukova 1995a, 1995b). Yasunaga (1994) illustrated the male genitalia of specimens with different coloration from Japan and the Russian Primorskij Kraj, and mentioned that, what had been called *olivaceus* in this region, includes at least three different species and is in need of revision.

Recently, through the courtesy of Prof. M. Josifov of Bulgarian Academy of Sciences, we obtained several specimens of 'true' European *olivaceus*, and, upon

examination, the eastern Palearctic specimens were found to differ significantly in some structures from the European ones. Therefore, the populations occurring in eastern Eurasia (southern part of Siberia including Irkutsk, the Russian Far East, north-eastern China, Mongolia and Japanese Honshu) cannot be regarded as conspecific with those of Europe (= true *olivaceus*), but should be called *brachialis*. On the other hand, specimens from Shikoku and Kyushu, south-western Japan, correspond to neither *olivaceus* nor *brachialis* in having a bright red and densely pubescent dorsum, impunctate and setose scutellum, noticeably pubescent hemelytra and different structure of the male genitalia; they are considered to belong to an undescribed species. Further, one of the authors, Yasunaga, collected a pair of specimens with entirely blackish bodies from southern Primorskij Kraj, Russia. Such remarkable blackish specimens have previously been regarded as a variant of *olivaceus* (= *brachialis*) only (Kerzhner 1988b; Kerzhner pers. comm.), although distinct differences are found in the female antennal segment I and male genitalia as described below; therefore, these specimens cannot be





Figs. 1-8. Parameres of *Deraeocoris* spp. – 1-2, *D. olivaceus* from Bulgaria; 3-4, *D. brachialis*, 3-4, S. Primor'je, Russia; 5-6, Mt. Sasagamine, Niigata Pref., Honshu, Japan; 7-8, Mts. Yatsugatake, Nagano Pref., Honshu, Japan. – 1, 3, 5 & 7, left paramere; 2, 4, 6 & 8, right paramere. Scales: 0.2 mm.

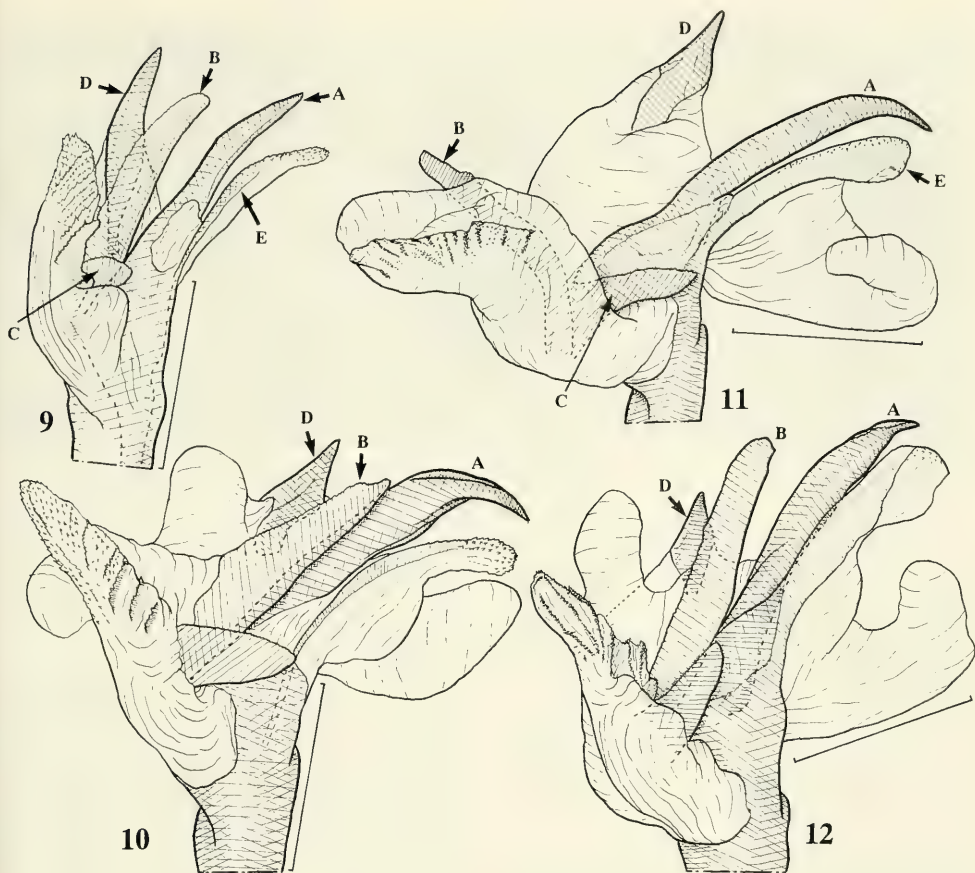
considered conspecific with *olivaceus* or *brachialis*. In the present paper, the true *Deraeocoris olivaceus* (Fabricius), which is restricted to Europe and adjacent regions, is diagnosed, and the specific name, *D. brachialis* Stål, is reinstated as valid for the eastern Palearctic specimens. Two new species, *D. gibbantenatus* from southern Primorskiy Krai, Russia and *D. erythromelas* from Kyushu and Shikoku, Japan, are described. A key is provided to distinguish *D. olivaceus* and its allies, and the zoogeography is also discussed.

#### MATERIAL AND METHODS

In general dried specimens were used. Depositories of material examined are abbreviated in the text as follows: Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan (ELKU);

Biological Laboratory, Hokkaido University of Education, Sapporo, Japan (HUES); Dr. Miyamoto's personal collection, Fukuoka, Japan (MC); Museum of Nature and Human Activities, Hyogo, Japan (MNHA); National Institute of Agro-Environmental Science, Tsukuba, Japan (NIAES); Zoological Institute, National Science Museum, Tokyo, Japan (NSMT); Entomological Laboratory, University of Osaka Prefecture, Sakai, Japan (UOP); Zoological Institute, Russian Academy of Sciences, St. Petersburg (ZMAS).

All measurements in the text are given in millimeters. In the synonymic listings only original references and selected references subsequent to Carvalho's catalogue (Carvalho 1957) are cited for each taxon (detailed synonymic listing provided by Schuh 1995).



Figs. 9-12. Vesicae of *Deraeocoris* spp. – 9, *D. olivaceus* from Bulgaria; 10-12, *D. brachialis*, 10, S. Primor'je, Russia; 11, Marunuma, Gunma Pref., Honshu, Japan; 12, Mts. Yatsugatake, Nagano Pref., Honshu, Japan. Scales: 0.5 mm.

### Terms for descriptions of male genitalia

Male genitalia of the plant bugs form, needless to say, very important taxonomic characters, and it is necessary to describe and/or illustrate them properly. Because *Deraeocoris olivaceus* and allied species possess five homologous sclerites on the vesica, we use here alphabetical terms to avoid misunderstanding (see characters A-E in figs. 9-12, 20, 24).

Sclerite A is the most conspicuous, horn-like appendage, and may be interpreted as the 'spiculum'. The vesicae of *olivaceus* and allies are principally divided into three membranous lobes, and the first lobe is accompanied by two flat sclerites (B & C), which are sometimes fused together basally. 'Sclerite D' is situated on another lobe, tapered and pointed apically. The fifth sclerite (E) is a partly or entirely sclerotized extension of the third lobe. These five sclerites form important characters for the classification of *D. olivaceus* and allies.

### TAXONOMY

#### *Deraeocoris olivaceus* (Fabricius) (figs. 1-2, 9, 25)

*Cimex olivaceus* Fabricius, 1777: 300.

*Deraeocoris olivaceus* – Reuter 1888: 648; Kiritschenko 1951: 159, fig. 166; Carvalho 1957: 71; Southwood & Leston 1959: 206; Leston & Woodroffe 1961: 188; Wagner & Weber 1964: 40; Wagner 1971: 36; Günther & Schuster 1990: 369; Melber & al. 1991: 92; Gorczyca 1992: 91; Schuh 1995: 615.

*Deraeocoris brachialis* – Kiritschenko 1951: 160.

#### Diagnosis

Recognised by the smallest body among the relatives (up to 10.7 mm in length; redescrptions below indicating the dimension ranges from 8.5-10.5 mm), narrow head, wide vertex (0.45-0.50 times as wide as head including eyes), generally short antennal segments, relatively incrassate antennal segment II (api-



Figs. 13-15. Dorsal habitus of *Deraeocoris* spp. – 13, *D. brachialis*; 14, *D. gibbantennatus*; 15, *D. erythromelas* on willow.

cal part more than 1.5 times as thick as base), bicolourous antennal segment III (basal part widely pale and apical part infuscate), and short legs. Very variable species in coloration. In Europe, its closest relative is *D. trifasciatus* (Linnaeus), from which *olivaceus* is easily separated by the significantly smaller size and different coloration.

Detailed descriptions were provided by several European authors (Reuter 1896; Wagner 1952, 1971; Wagner & Weber 1964, etc.).

### Description

Male genitalia. – Parameres as in figs. 1-2; protuberance of left paramere not strongly curved (fig. 1). Vesica (fig. 9) comparatively small in general shape; sclerite A rather slender and straight; sclerite C short, accompanied with second triangular process; sclerite D elongate.

Dimensions. – ♂/♀: Body length (from anterior apex of tylus to posterior tip of membrane) 9.90-10.68/ 10.02-10.20; head width including eyes 1.40-1.48/ 1.50-1.53; vertex width 0.65-0.68/ 0.75; length of antennal segment I 0.90-0.98/ 0.97-1.00, II 2.97-3.18/ 3.25-3.28, III 1.00-1.05/ 1.05-1.12, IV 0.63-0.72/ 0.70-0.73; rostral length 3.70-3.83/ ?; mesal pronotal length including collar 1.92-2.22/ 2.15-2.23; basal pronotal width 3.27-3.58/ 3.47-3.68; maximum width across hemelytra 4.15-4.63/ 4.50-4.73; length of hind femur 3.00-3.73/ 3.12-3.33, tibia 4.00-4.25/ 4.00-4.20, tarsus 1.07-1.18/ 1.12-1.18; length of hind tarsomere I 0.48-0.50/ 0.50-0.51, II 0.36-0.38/ 0.37-0.40, III 0.45-0.48/ 0.48-0.50.

### Distribution

Europe: central part to the Mediterranean area, Britain, and the European part of Russia, west of the

Ural range, and North Africa: Algeria. This species appears to be restricted to the western Palearctic Region.

### Biology

*D. olivaceus* has been reported to be associated with Rosaceae, such as *Crataegus*, *Malus*, *Pirus* and *Prunus* (Wagner 1952, 1971, Wagner & Weber 1964), and in spite of being principally predaceous, it has been observed to feed on young hawthorn berries (*Crataegus*) (Southwood & Leston 1959). In Bulgaria, Dr. Josifov collected two males from *Quercus cerris* L. (Fagaceae), which we could not confirm as the host plant.

Material examined. – BULGARIA: 3♂, 2♀, Kalotina, 20.vi.1993, M. Josifov (HUES); 2♂, Plana u., Kokaljane, 1,000 m, on *Quercus cerris*, 23.vi.1968, M. Josifov (HUES).

### *Deraeocoris brachialis* Stål sp. rev. (figs. 3-8, 10-13, 25)

*Deraeocoris brachialis* Stål 1858: 185; Carvalho 1957: 61; Kulik 1965a: 170; Kulik 1965b: 50; Kerzhner 1978: 37. *Deraeocoris olivaceus* – Kerzhner 1988a: 67; Kerzhner 1988b: 794; Miyamoto & Yasunaga 1989: 158; Yasunaga 1990: 665; Josifov 1992: 117; Yasunaga & al. 1993: 146, fig. 7b; Lee & al. 1994: 7; Yasunaga 1994: 41; Vinokurov & Kanyukova 1995a: 13; Vinokurov & Kanyukova 1995b: 85.

### Diagnosis

Recognised by the enlarged body (more than 11 mm in most specimens), wide head, narrow vertex, long antennal segments, less incrassate antennal segment II, unicolorous dark antennal segment III (only



extreme base rarely narrowly pale), and long legs. Very variable species in coloration.

This eastern Palearctic species is a close relative of *olivaceus*, from which it can be distinguished by the characters as diagnosed above and different structure of the male genitalia. Reuter (1896) provided a detailed redescription, in which he showed that *brachialis* is significantly larger than *olivaceus*. But his key is currently not applicable because the variable coloration was used as the key character.

### Redescription

Body elongate oval ( $\delta$ )/ oval and tumid ( $\eta$ ); dorsal surface usually brownish, shining, widely punctate. Head brown with dark symmetrical marking, or entirely darkened, shining, oblique and rather wide; vertex 0.37-0.45 ( $\delta$ )/ 0.39-0.46 ( $\eta$ ) times as wide as head including eyes, with sparse, silky, very short pubescence; tylus, jugum, buccula and gena with dense, silvery, suberect pubescence. Antenna dark chestnut brown; segment I and basal part of II sometimes widely brown or reddish brown; segment II less incrassate toward apex, its apical part less than 1.5 times as wide as base; segments III and IV filiform, extreme base of segment III rarely pale; length of segments I-IV ( $\delta/\eta$ ): 1.05-1.18/ 0.99-1.25, 3.40-3.78/ 3.23-4.00, 1.22-1.50/ 1.30-1.55, 0.76-0.90/ 0.77-0.88. Rostrum shiny dark chestnut brown, sometimes partly pale, reaching or slightly exceeding middle coxa.

Pronotum very variable in coloration, pale brown (usually with darkened calli) to widely darkened, shining, uniformly with dense, fuscous punctures and laterally with silky, erect pubescence, posterior margin usually impunctate; collar sombre yellowish brown to fuscous, shagreened or pruinose, bearing silky, erect pubescence; mesoscutum shiny fuscous, with shagreened lateral parts, bearing sericeous pubescence; scutellum shiny dark brown, with pale lateral and posterior margins forming v-shape, shallowly but distinctly punctate, bearing a few, silky, very short setae. Hemelytra brown, or pale, reddish, purplish or dark brown, shining, almost glabrous, with dense, dark punctures; apical part of corium widely infusate; ventral surface of embolium densely pubescent; cuneus yellow, brown, orange or red, with always infusate apical 1/3-1/2 parts; membrane sombre pale brown to brown, narrowly pale near apex of cuneus. Legs uniform with brownish, suberect setae; femora widely chestnut brown or dark brown, or pale brown with dark patches; tibiae reddish brown to fuscous, each with two yellow bands; tarsi dark brown, with dense, blush-like setae inward; length of hind femur, tibia and tarsus ( $\delta/\eta$ ): 3.52-4.05/ 3.25-4.33, 4.75-5.33/ 4.42-5.63, 1.25-1.38/ 1.15-1.50; that of hind tarsomeres I-III ( $\delta/\eta$ ): 0.50-0.60/ 0.54-0.70, 0.43-0.48/ 0.37-0.51, 0.48-0.60/ 0.44-0.60. Ab-

domen pale brown, reddish brown or dark chestnut brown.

Male genitalia. — Somewhat variable in shape. Parameres as in figs. 3-8; protuberance of left paramere distinctly curved. Vesical sclerite A is strong, broad and apically hooked; sclerite C developed; sclerite D rather shortened (figs. 10-12).

Dimensions. —  $\delta/\eta$ : Body length 10.42-12.90/ 10.02-12.20; head width including eyes 1.57-1.80/ 1.57-1.75; vertex width 0.62-0.70/ 0.75-0.83; rostral length 3.65-4.25/ 3.62-4.28; mesal pronotal length including collar 2.25-2.48/ 2.00-2.73; basal pronotal width 3.72-4.05/ 3.42-4.45; maximum width across hemelytra 4.67-5.30/ 4.47-5.50.

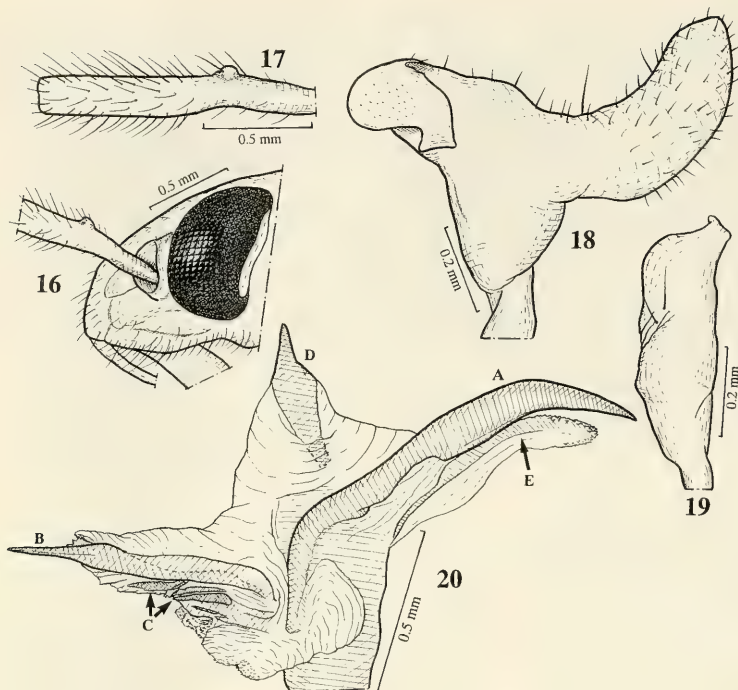
### Distribution

Russia (possibly east of Altai and south of Stanovoj ranges: South Siberia including Irkutsk and Tuva, continental Far East and South Sakhalin), Japan (North and Central Honshu), Mongolia, North-east China, North- and South-Korea.

### Biology

Kerzhner (1978) recognised *Salix* sp. (Salicaceae) as its host plant, and Yasunaga (1994) also recorded willow (*Salix* spp.) and alder (*Alnus* spp., Betulaceae). Predation on larvae of chrysomelid beetles (e.g., *Gonioctena japonica* Chujo et Kimoto, 1960 on alder and *Chrysomela vigintipunctata* (Scopoli, 1763) on willow) has been frequently observed, and cannibalism was also reported (Yasunaga 1990).

Material examined. — RUSSIA: S. Primorskij Kraj: 1  $\eta$ , Ussurijsk Reserve, 15.vii.1990, T. Saigusa (HUES); 1  $\delta$ , Ussurijsk Reserve, W. border, 12-13.vii.1993, light trap, T. Yasunaga (HUES); 2  $\delta$ , 16  $\eta$ , 17 km SW of Krounovka, nr. Mt. Medvezh'ja, on alder & willow, 5-9.vii.1993, T. Yasunaga (HUES); 2  $\delta$ , Rjazanovka, Khasanskij Dist., 26-27.vii.1993, light trap, T. Yasunaga (HUES). — CHINA: 1  $\delta$ , N. Manchuria (= current Heilongjiang Prov. of NE. China), 1940, A. Loukashikin (NIAES). — JAPAN: Honshu: 1  $\delta$ , 1  $\eta$ , Mt. Sasagamine, Niigata Pref., 20-25.vii.1993, S. Yoshizawa (HUES); 1  $\eta$ , Nikko, Tochigi Pref., 19.vii.1949, J. Aoki (NIAES); 1  $\eta$ , same locality, 14.vi.1950, M. Yano (NIAES); 2  $\delta$ , same locality, 17-19.vii.1959, T. Maenami (NIAES); 1  $\delta$ , Nebasawa, Oku-nikko, Tochigi Pref., 11.vii.1937, G. Yamamoto (NIAES); 1  $\eta$ , Ozeegahara, Gunma Pref., 9.vii.1951, H. Hasegawa (NIAES); 3  $\delta$ , 3  $\eta$ , same locality, 9-10.vii.1978, M. Tomokuni (NSMT); 1  $\eta$ , Fujimishita, nr. Ozeegahara, Gunma Pref., 22.vii.1987, Y. Notsu (NSMT); 1  $\delta$ , Marunuma, Gunma Pref., 7.vii.1984, M. Hayashi (HUES); 1  $\delta$ , 4  $\eta$ , Mt. Kanayama, Yamanashi Pref., 6.vi.1952, M. Ohno (NIAES); 1  $\eta$ , Masutomi, Yamanashi Pref., 28.vii.1957, S. Kimoto (MC); 1  $\eta$ , Daimonzawa, Mt. Akadake, 2,000-2,500 m alt., Mts. Yatsugatake, Yamanashi Pref., 30.vii.1987, T. Yasunaga (HUES); 4  $\delta$ , Nippara, Tokyo, 12.vii.1986, M. Tomokuni (NSMT); 1  $\delta$ , Komoro, Nagano Pref., 29.vii.1959, T. Maenami (NIAES); 1  $\eta$ , Omachi, Nagano Pref., 26.vi.1977, M. Owada (NSMT); 1  $\delta$ , Mikasa Park, Karuizawa, Nagano Pref., 31.vii.1968, H.



Figs. 16-20.

*Deraeocoris gibbantennatus*. – 16, female head in left lateral view; 17, female antennal segment I; 18, left paramere; 19, right paramere; 20, vesica.

Ono (NSMT); 1♂, Ueda C., Nagano Pref., vi.1934, S. Miyamoto (ELKU); 2♂, 2♀, Todai, Kami-ina, Nagano Pref., 8-11.vii.1978, M. Owada (NSMT); 1♀, Sugadaira, Nagano Pref., 18.viii.1956, K. Baba (NIAES); 1♂, Shiga Plateau, Nagano Pref., 6.viii.1974, Y. Hori (NSMT); 1♀, same locality, 3-6.viii.1982, M. Sato (NSMT); 3♂, 4♀, Mt. Azusayama, Kawakami Vil., Nagano Pref., 5.vii.1980, Y. Kurosawa (NSMT); 3♂, 1♀, Minoto, Mt. Akadake, 2,000-2,500 m alt., Mts. Yatsugatake, Nagano Pref., 27.vii.1987, T. Yasunaga (HUES); 1♂, Inakoba, Mts. Yatsugatake, Nagano Pref., 18.vii.1939, H. Hasegawa (NIAES); 2♂, Sanjiro, Utukushigahara, Nagano Pref., 30.vii.1954, K. Kai (NIAES); 1♀, Shimashima Valley, Nagano Pref., 3-5.viii.1940, K. Kurosa (NIAES); 1♂, same locality, 7.viii.1955, H. Hasegawa (NIAES); 1♀, Iwana-dome, Shimashima Valley, Nagano Pref., 14.vii.1982, Y. Abe (HUES); 1♀, Tokugo Pass, Nagano Pref., 7.viii.1955, H. Hasegawa (NIAES); 3♀, Kamikochi, Japan Alps, Nagano Pref., 21.vii.1917, T. Esaki (ELKU); 1♂, 2♀, same locality, 15.vii.1945, M. Yano; 2♀, same locality, 20.viii.1936, K. Kurosa (NIAES); 1♀, same locality, 12.viii.1952, T. Nakane (NIAES); 2♂, 2♀, same locality, 3-7.viii.1955, I. Hattori (NIAES); 1♀, same locality & collector, 18-19.vii.1956 (NIAES); 2♂, 3♀, same locality & collector, 14-18.vii.1960, I. Hattori (NIAES); 2♀, same locality, on alder, 21.vii.1957, M. Ohno (NIAES); 1♀, same locality, 3.viii.1956, M. Sato (NSMT); 6♂, 10♀, Mt. Nyugasa, Nagano Pref., 29-31.vii.1962, S. Miyamoto (MC); 1♀, Mt. Senjodake, Nagano Pref., 3.viii.1958, H. Yamamoto (MC); 1♂, Isedaki, Komagatake, Nagano Pref., 1.viii.1962, S. Miyamoto (MC); 2♂, Nagawa Vil., Nagano Pref., 21.vii.1994, Y. Sawada & T. Ueda (UOP); 1♂, 1♀, Kiso-Ontake, Nagano Pref., 20.vii.1952, H. Hasegawa (NIAES); 2♀, Hirayu, Gifu Pref., 22-23.vii.1946, K. Ohbayashi

(NSMT); 1♀, same locality, 26.vii.1986, S. Miyakawa (NSMT); 1♂, Mt. Wasamata, Nara Pref., 3.viii.1995, T. Hirowatari (UOP); 1♂, 2♀, Kobe C., Hyogo Pref., 20.vi.1940, K. Kurosa (NIAES).

#### *Deraeocoris gibbantennatus* sp. n.

(figs. 14, 16-20, 25)

*Deraeocoris olivaceus* – Kerzhner 1988b: 794; Yasunaga 1994: 43, fig. 14.

Type Material. – Holotype ♂, 17 km SW of Krounovka, near Mt. Medvezh'ja, S. Primorskij Kraj, Russia, on *Alnus* sp., 5-7.vii.1993, T. Yasunaga (ZMAS). – Paratype: 1♀, same data as for holotype, 8-9.vii.1993 (HUES).

#### Diagnosis

This species is easily distinguished from other relatives by the entirely blackish dorsum (fig. 14) and peculiar hump-like projection on the female antennal segment I (figs. 16-17). The shape of the vesical sclerite is also unique to this species.

#### Description

Body almost entirely shiny black, oblong-oval (♂)/oval (♀); dorsal surface distinctly punctate; ventral surface uniformly darkened. Head black, shining, with silvery, suberect, short pubescence; vertex somewhat pale near inner margin of eye, relatively narrow,

0.36-0.37 times ( $\delta$ )/ 0.43 times ( $\varphi$ ) as wide as head including eyes. Antenna entirely blackish brown, densely setose;  $\varphi$  segment I with a dorsal, hump-like projection at basal 1/4; segment II rather incrassate toward apex, apical part 1.6-1.7 times as thick as base; segments III and IV filiform; length of segments I-IV ( $\delta/\varphi$ ): 1.25/ 1.25, 3.88/ 3.96, 1.50/ 1.48, 0.83/ 0.83. Rostrum shiny dark chestnut brown, reaching middle coxa.

Pronotum black, shining between punctures, with brown, upright setae laterally, posterior margin somewhat pale; collar shagreened or pruinose, bearing silky, erect pubescence; mesoscutum black, shagreened laterally, with sparse, silky, short pubescence; scutellum shiny dark chestnut brown, with yellow extreme apex, timid, punctate, bearing very sparse, silky, short pubescence. Hemelytra unicolorous shiny black, densely punctate, with silky, short pubescence along lateral margin; ventral surface of embolium densely pubescent. Leg dark brown, densely setose; each tibia with two yellowish bands; tarsi with dense, blush-like setae inward; length of hind femur, tibia and tarsus ( $\delta/\varphi$ ): 4.00/ 4.03, 5.25/ 5.33, 1.40/ 1.43; that of hind tarsomeres I-III: 0.55/ 0.60, 0.48/ 0.52, 0.53/ 0.61. Abdomen entirely shiny blackish.

Male genitalia. – Parameres as in figs. 18-19. Vesica apparently specialised in form (fig. 20); sclerite A elongate, tapered at apex; sclerite B narrow, widely fused with a membranous lobe; sclerite C reduced, divided into several smaller plates; sclerite C weak.

Dimensions. –  $\delta/\varphi$ : Body length 12.90/ 11.94; head width including eyes 1.78/ 1.74; vertex width 0.65/ 0.75; rostral length 4.00/ 4.28; mesal pronotal length including collar 2.35/ 2.63; basal pronotal width 4.00/ 4.35; maximum width across hemelytra 5.08/ 5.75.

### **Etymology**

From Latin, gibba or gibbus (= hump) in combination with antenna, referring to the characteristic hump-like projection exhibited on the female antennal segment I.

### **Distribution**

Russian Far East (S. Primorskij Kraj).

### **Biology**

*D. gibbantennatus* was found on *Alnus* sp. (Betulaceae), with which it appears to be associated. It was collected together with *D. brachialis*, but in lower population densities.

### ***Deraeocoris erythromelas* sp. n.**

(figs. 15, 21-25)

*Deraeocoris olivaceus* – Yasunaga & al. 1993: 146, fig. 7a; Yasunaga 1994: 42, fig. 15.

Type material. – Holotype  $\delta$ , Momiki, 600-700 m alt., Izumi Vil., Kumamoto Pref., Kyushu, Japan, at light, 6.vii.1991, K. Yahiro (HUES). – Paratypes: Shikoku: 1  $\delta$ , Nishikuma, Monobe Vil., Kochi Pref., 30.vii.1994, M. Takai (HUES); 1  $\varphi$ , Teragawa, Hongawa Vil., Kochi Pref., light trap, 18.vii.1993, I. Yamashita (HUES); 1  $\delta$ , same locality and collector, 25.vii.1991 (UOP); 1  $\varphi$ , Hongawa Vil., 800-1,400 m alt., Kochi Pref., on *Betula* sp., 23.vii.1996, T. Yasunaga (HUES); 1  $\varphi$ , Mt. Tsurugi, Tokushima Pref., light trap, 10.vii.1993, I. Yamashita (HUES); 1  $\varphi$ , Mt. Odamiyama, Ehime Pref., 12.vii.1994, M. Takai (HUES). – Kyushu: 1  $\delta$ , Mt. Shiratori, Izumi Vil., Kumamoto Pref., 21.vi.1987, R. Noda (HUES); 1  $\varphi$ , same locality, 19.vii.1992, Y. Nakatani (UOP); 1  $\varphi$ , Mt. Yamaingiri 1,100 m alt., Izumi Vil., Kumamoto Pref., on *Salix* sp., 28.vi.1992, T. Yasunaga (fig. 15, HUES); 1  $\delta$ , same locality, light trap, 16.vii.1994, R. Matsumoto (HUES); 1  $\varphi$ , Mt. Sobo, Oita Pref., 25.vii.1978, Y. Shono (MNHA); 1  $\varphi$ , Kamihori, Miyazaki Pref., 15.vii.1967, S. Tawara (MC).

### **Diagnosis**

This species is easily distinguished from other relatives by the bright red and partly infusate dorsum, silky suberect pubescence on the impunctate scutellum, and uniformly pubescent hemelytra, in addition to having a quite restricted distribution.

### **Description**

Body elongate oval, large; dorsal surface noticeable bright red, partly or sometimes widely infusate, provided with silky, suberect pubescence; ventral surface widely darkened. Head dark chestnut brown, shining, with silky, suberect pubescence; vertex with a pale spot near inner margin of each eye, comparatively wide, 0.43-0.44 ( $\delta$ )/ 0.50-0.52 ( $\varphi$ ) times as wide as head including eyes; tylus, jugum, buccula and gena bearing rather dense, silky, long pubescence. Antenna dark chestnut brown, with dense, erect, long setae; apical part of segment II more than 1.5 times as thick as base; segments III and IV somewhat paler, filiform; length of segments I-IV ( $\delta/\varphi$ ): 1.12-1.15/ 1.22-1.28, 3.52-3.75/ 3.50-4.13, 1.18-1.25/ 1.26-1.40, 0.75-0.78/ 0.89-0.91. Rostrum shiny dark chestnut brown, reaching middle coxa.

Pronotum usually bright red, shining, sometimes tinged with purple or brown, uniformly bearing brownish, erect pubescence, with dark punctures; calli sometimes infusate; collar dark grey, shagreened, with dense, brownish, erect setae; mesoscutum black-



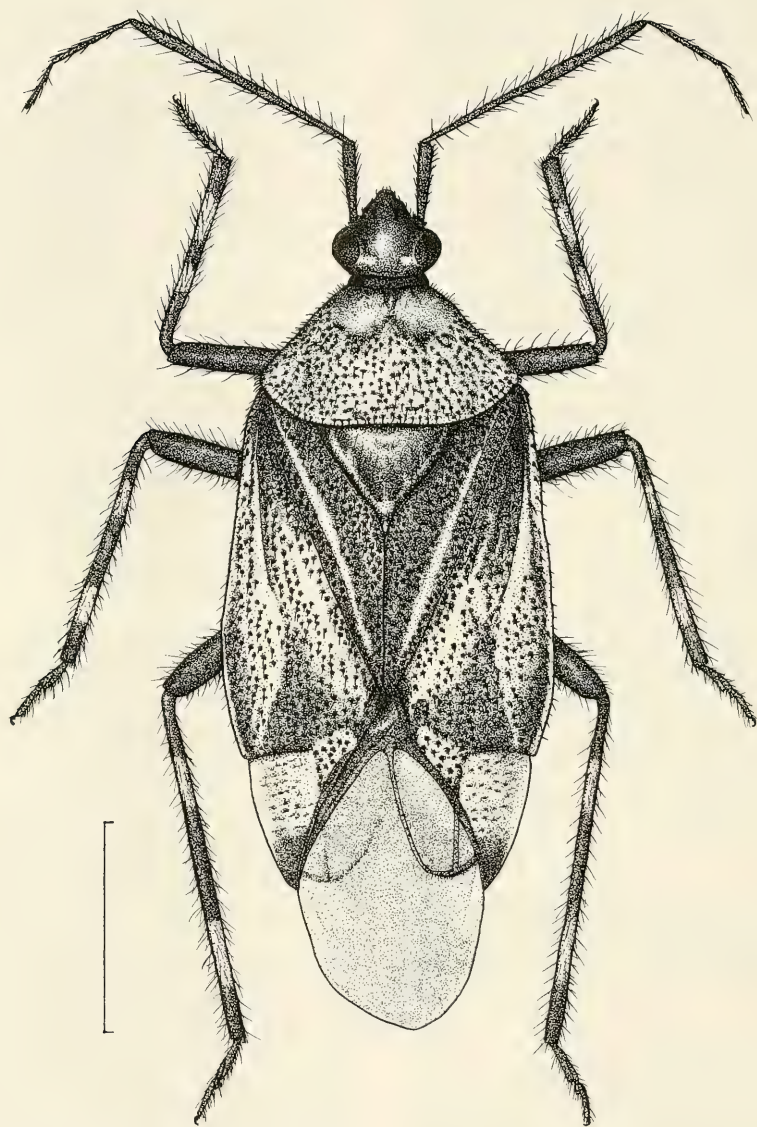
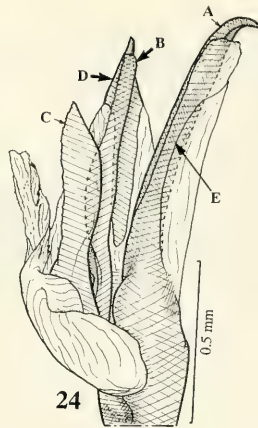
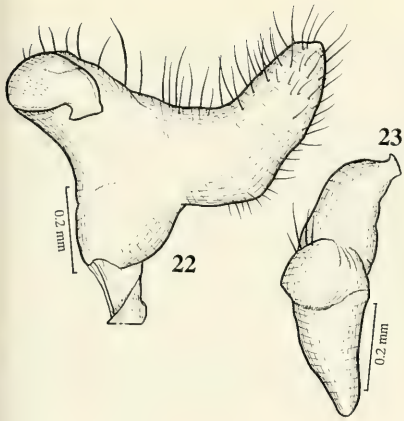


Fig. 21. *Deracocoris erythromelas*, dorsal habitus. Scale: 3 mm.



Figs. 22-24.

Male genitalia of *Deraeocoris erythromelas*. — 22, left paramere; 23, right paramere; 24, vesica.

ish, laterally with greyish pollinosity, bearing sparse, silky pubescence; scutellum red, shining, triangularly darkened medially, impunctate or very shallowly punctate, uniformly clothed with silky, erect pubescence. Hemelytra shiny red, sometimes tinged with purple or brown, punctate, uniformly clothed with silky, suberect pubescence; corium and clavus partly or sometimes widely infuscate; cuneus bright red, with darkened apical 1/3-1/2 parts; membrane sombre greyish brown, with a pale spot near apex of cuneus. Leg dark chestnut brown; femora and tibiae with dense, brownish, erect setae; each tibia with two yellowish white bands; tarsi with dense, bluish-like setae; length of hind femur, tibia and tarsus ( $\delta/\eta$ ): 3.65-3.75/ 3.80-4.25, 4.72-4.93/ 4.97-5.38, 1.20-1.25/ 1.30-1.38; that of hind tarsomeres I-III ( $\delta/\eta$ ): 0.48-0.50/ 0.57-0.60, 0.42-0.46/ 0.44-0.48, 0.49-0.53/ 0.55-0.60. Abdomen shiny dark brown.

Male genitalia. — Parameres (figs. 22-23) distinctly setose; left paramere densely furnished with long sensory setae (fig. 22). Vesical sclerites A and B long and slender; sclerite C well developed; sclerite D extended basally (fig. 24).

Dimensions. —  $\delta/\eta$ : Body length 10.98-12.00/ 10.92-12.03; head width including eyes 1.60-1.65/ 1.66-1.73; vertex width 0.70-0.73/ 0.85-0.88; rostral length 3.57-3.93/ 3.82-4.08; mesal pronotal length including collar 2.35-2.43/ 2.57-2.68; basal pronotal width 3.85-3.90/ 3.97-4.38; maximum width across hemelytra 4.81-4.99/ 5.22-5.88.

### ***Etymology***

From Greek erythro- (= red) and melas (= black), referring to the bright red and partly infuscate body of this new species.

### ***Distribution***

Japan (central montane areas of Shikoku and Kyushu).

### ***Biology***

*D. erythromelas* has been found on *Betula* sp. (Betulaceae) and *Salix* spp. (Salicaceae). Predation on larvae of the chrysomelid beetle, *Chrysomela vigintipunctata* (Scopoli, 1763) (Coleoptera) on willow was observed in Kyushu. A last-instar nymph was found to have been parasitized by an undetermined nematode (Yasunaga, unpublished data).

### **KEY TO SPECIES OF *D. olivaceus* AND ALLIES**

1. Scutellum shiny and impunctate, with silky, suberect pubescence; hemelytra distinctly pubescent ..... *D. erythromelas*
- Scutellum distinctly punctate, glabrous; hemelytra lacking noticeable pubescence except on embolium ..... 2
2. Dorsal surface entirely shiny black;  $\eta$  antennal segment I with a peculiar dorsal hump-like projection ..... *D. gibbantennatus*
- Dorsal surface partly or widely reddish, brownish or yellowish;  $\eta$  antennal segment I lacking such projection ..... 3
3. Body larger, usually more than 11 mm in length; antennal segment I longer, more than 1 mm; antennal segment III unicolorously darkened, or only extreme base rarely pale; eastern Palearctic species found on Salicaceae and Betulaceae . . . *D. brachialis*
- Body smaller, up to 10.7 mm in length; antennal segment less than 1 mm; antennal segment III bicolorous, dark with widely pale base; western Palearctic species associated mainly with Rosaceae . . . *D. olivaceus*

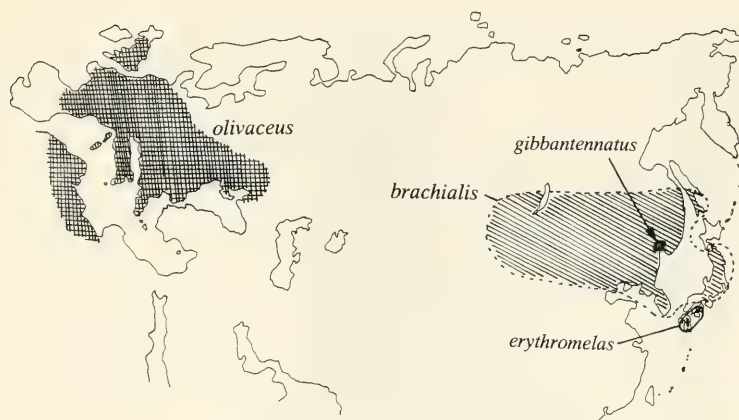


Fig. 25.

Distribution of *Deraeocoris olivaceus* and allies.

## ZOOGEOGRAPHY (fig. 25)

The four treated species have in the past been represented as a single species, *olivaceus*, which was considered to be a widely distributed Palearctic species. After a careful check of the previous distributional records, we realized that *D. olivaceus*, *D. brachialis* and *D. erythromelas* are obviously allopatrically distributed. *D. olivaceus* is restricted to the western Palearctic Region including the Mediterranean area, *D. brachialis* is distributed in southern Siberia, the Russian Far East, Mongolia, the Korean Peninsula and Honshu, Japan, and *D. erythromelas* has the southernmost distribution, being endemic to central montane areas of Shikoku and Kyushu Islands, south-western Japan. Only *D. gibbantennatus* was found sympatric with *brachialis* in the Russian Primorskij Territory.

Of the four species, *D. olivaceus* and *D. brachialis* are the most closely related species. However, none of these has been reported from the region between the Ural and Altai ranges. The mountains are considered to form a barrier, dividing the distribution ranges of the western *D. olivaceus* and eastern *brachialis*.

Our observations and previous reports indicate that these two species have different host preferences; *D. olivaceus* is associated with rosaceous host plants (Southwood & Leston 1959; Wagner 1952, 1971; Wagner & Weber 1964), while *D. brachialis* has been found only on alder (Betulaceae) and willow (Salicaceae). As pointed out by Todo & Yasunaga (1996) and Yasunaga (1996), many deraeocorine species, in spite of being predaceous, live on restricted plant species. The different preference for plant species may be a diagnostic character.

Kerzhner (1988b) regarded specimens, here named

as *D. gibbantennatus*, as conspecific with *D. brachialis*, but a peculiar hump-like dorsal projection on the female antennal segment I is considered to be an autapomorphy for *gibbantennatus* (see figs. 16-17). The shape of sclerites B and C on the male vesica is also unique to *gibbantennatus*, which is, therefore, here regarded to be a good species.

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## BOOK REVIEW

Stig Andersen, 1996. The Siphonini (Diptera: Tachinidae) of Europe. – Fauna Entomologica Scandinavica, Volume 33, E.J. Brill. 148 pp., 6 colour plates, 275 text figs. Hardback [ISBN 90 04 10731 2]. Price HfL 114.50 excl. postage.

Volume 33 of the well-known series 'Fauna Entomologica Scandinavica' deals with the European species of the tribe Siphonini of the family Tachinidae. It is a typical member of the series, considering the layout, many text figures, few colour plates and information on distribution of species in Scandinavia. On the other hand, this volume differs from all the others in the fact that its scope is restricted to one tribe and that all European species of this tribe have been included. Moreover, there are quite a lot of taxonomic novelties in this volume, so that it is best to consider this volume to be a full-grown review of the European Siphonini.

Whereas the taxonomy of the family Tachinidae is considered by most dipterologists to be difficult, that of the tribe Siphonini is even more complicated. Especially the genus *Siphona* is quite notorious in this respect. Until the sixties of this century only four European species of *Siphona* were generally accepted. Mesnil (in Lindner) raised the number of European species to 13, still leaving many problems unsolved. Stig Andersen must be praised for continuing Mesnil's difficult task, leading to a review of the genus *Siphona* in 1982 containing 17 species. In his present work, 20 European species of *Siphona* have been recognised.

The introductory chapters of the book deal with the classification and the lifehistory of the Siphonini. The part on classification and phylogeny is quite extensive, but rather technical for most readers. The part on the life-history contains some interesting new material. Although many host-relations are still undiscovered, it becomes more and more clear that very similar species may have quite different hosts.

The main part of the book is dedicated to the taxonomy of the 58 European species, starting with a key to genera. Next each genus is characterised, its distribution on a world-scale is given, followed by a key to the European species. For each species the typical features, distribution and biology are discussed. The text is illustrated with simple but clearcut black-and-white figures. Also all male genitalia have been illustrated. It is my experience that the keys, in general, make a re-

liable identification possible. Compared with earlier work, Andersen has introduced several new features, making it sometimes possible to recognise even aberrant specimens. Some previously recognised species are now considered to be only a variety of a very similar taxon (*Actia dubitata* of *crassicornis* and *Siphona confusa* of *variata*). Given the many intermediate forms and the variability of these species, I totally agree with Andersen's view. On the other hand, six new species have been described. Some of the new species can easily be recognised, whereas others are very similar to related species. It is my experience that Andersen tends to underestimate the variability in these cases: for instance Dutch males of *Peribaea hertingi* Andersen cannot be recognised with his key.

A major point of criticism concerns the nomenclature used. Scandinavian dipterologists have a tendency of very strictly interpreting nomenclatural rules, not seldomly leading to highly impractical results. To introduce the name *resinellae* (Schränk, 1824) for the species previously known as *Actia nudibasis* Stein, 1924 while Schränk's types are lost is perhaps not too big a problem. But to synonymise *Siphona mesnili* Andersen, 1982 with *Siphona confusa* Mesnil, 1961 and *S. confuse* Andersen, 1982 with *S. variata* Andersen, 1982 and then introducing *Siphona variata* forma '*confusa* Andersen' is very confusing indeed, to say the least. Finally, renaming the common *S. cristata* to *S. geniculata* (De Geer, 1776) and the very common *S. geniculata* to *S. urbana* (Harris, 1780) is really disastrous. Although formally undoubtedly correct, with this change of names *Siphona geniculata* can never be used without ambiguity. Andersen refers to this only as 'some confusion' and argues that '...the name has never had any longstanding and unambiguous usage ...'. Considering that *S. geniculata* and *cristata* had very clearly been separated by Staeger already in 1849 (and repeatedly by Lundbeck in 1927), this defence is just incorrect. In my opinion, these changes in names could and must have been prevented.

Andersen's book is a mature review of the European Siphonini. In the vast majority of cases, it will lead the more experienced student of Tachinidae to reliable identifications in this complicated tribe. Therefore, this book will be of great value to all serious students of the European Tachinidae. However, for the non-specialists with only little material available, using this fine book of Stig Andersen may be more cumbersome, especially in the genus *Siphona*. [Theo Zeegers]



## BOOK REVIEWS

Aleš Laštůvka & Zdeňek Laštůvka, 1997. *Nepticulidae Mitteleuropas. Ein illustrierter Begleiter* (Lepidoptera). – Konvoj, Brno. Hardback, 22×16 cm. [ISBN 80-85615-61-4]. Price DEM 72.–. Can be ordered from Department of Zoology and Apiculture, Faculty of Agronomy MUAf, Zěmědělská 1, CZ-613 00 Brno.

This small booklet is meant as a diagnostic guide for 184 species of Nepticulidae (leafmining Lepidoptera) occurring in Central Europe in a broad sense. Apart from traditional Central Europe, it includes species from Denmark, southern Sweden, The Netherlands, eastern half of France, northern Italy, Slovenia and Croatia. The book is therefore a welcome addition to the volume in the series *Fauna Entomologica Scandinavica* (vol. 23), which deals only with the 121 species of Northwest Europe. The book is written in German, the most important language in the area covered by the book, although this may hamper its usefulness for some countries.

All species are treated on a separate page, with a short diagnosis and notes on biology, distribution and habitats. On the same page there are black-and-white illustrations of a moth, male and female genitalia and leafmine, most original, excellently prepared by the senior author. A few are redrawn from other sources. There are no keys, but identification can be reached by comparing the illustrations. This may be somewhat difficult for those not yet familiar with the family, especially since similar genitalia are not depicted on the same page. Apart from the descriptions, there is a systematic list of hostplants and moth species, a checklist of the species and a distribution catalogue.

The book contains descriptions of four new species. Although a few more undescribed species are currently known from this region, this book is fairly comprehensive for a large part of Europe, excluding the southern peninsula's.

Minor points of criticism are the relatively simple drawings of the female genitalia and the lack of colour-plates of the adults. The latter, however, would have increased the price enormously.

In conclusion, a nice booklet, with a well chosen title: 'Ein illustrierter Begleiter' [an illustrated companion], to accompany fieldworkers and taxonomists. [Erik J. van Nieukerken]

Vereniging Onderzoek Flora en Fauna, 1997. *Jaarboek Natuur 1997, De winst- en verliesrekening van de Nederlandse natuur.* – KNNV Uitgeverij Utrecht/VOFF, Wageningen. [Society for Research on Flora and Fauna, 1997. Yearbook nature 1997. Profit and loss account of the Dutch nature.]. Hardback, 17×25 cm. [ISBN 90-5011-108-4]. Price NLG 40.– excl. p&tp. Order from KNNV Publishers, Fax +31-30-236 89 07.

Why reviewing a Dutch book on Dutch nature in an international entomological journal? There are very few countries where so many amateur naturalists are actively collecting data on the occurrence of plants, animals and insects as in The Netherlands. Maybe only in Britain there is a higher percentage of the population active in this field. Usually specialists in the various groups publish their results in their own circles. This book is a nice example of a broad view on nature: it tries to answer questions like: is the situation for nature in The Netherlands getting worse or better? There are treatments for 15 groups: from macrofungi, seedplants, to bats, sea-organisms and birds. But there are also insects: Orthoptera (grasshoppers and crickets), Odonata (dragonflies), Coleoptera: Carabidae (groundbeetles), Microlepidoptera, and Rhopalocera (butterflies). In all chapters authors try to estimate the trends in occurrence. Some species are declining, or extinct, others are increasing. The differences between groups are large, insects belonging to the groups with severe decline, especially in dragonflies and butterflies. It is nice to compare the various distribution maps and tables with numbers of gridcells in various periods.

Even for those not able to read Dutch, the book gives an interesting view of nature in an overpopulated European country: many nature-lovers studying little nature with few species. For foreign readers it is a disadvantage that many captions to the figures give trivial names only. Also an English summary is missing. Maybe this can be changed in future volumes in this series. The price is surprisingly low. [Erik J. van Nieukerken]

Volume 140

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# Tijdschrift voor Entomologie

A journal of systematic and evolutionary  
entomology since 1858



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